



FRIDAY, NOVEMBER 13, 1896.

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Contributions.

The Bridges on the Lake Shore and the Rock Island Track Elevation—A Correction.

In our issue of Nov. 6 we described the track elevation work of the Lake Shore and the Rock Island in Chicago. Concerning the bridge floors we said: "The floor system used in these bridges is entirely new, and is the design of Mr. Clark." This was an error. The floor system and all the rest of the ironwork was designed by Mr. Albert Lucius, of New York, as shown by plans sent to this office a year ago, when the first of these bridges was built.

Negative Lap or Inside Clearance on the Exhaust Side.

ALTOONA, Pa., Oct. 10, 1896.

TO THE EDITOR OF THE RAILROAD GAZETTE:

There seems to be considerable difference of opinion among locomotive designers in the matter of benefit derived by inside clearance of valves. Little by little, however, the amount of inside clearance has been increased until now we occasionally hear of simple engines with three-eighths of an inch, and in compounds even three quarters of an inch has been successfully used.

The speeds of simple engines are continually augmented. The effect of the compression line shows that we must either furnish greater freedom to the steam in getting out of the cylinder into the exhaust passage, or on the other hand provide more clearance space in the cylinder itself, into which to compress the steam at the end of each stroke. To analyze the effect of both methods we may base our observations on actual indicator cards taken from an eight-wheel passenger engine (see Fig. 1).

The speed at which this card was taken was 270 revolutions per minute, the valve having no inside lap or clearance, being line and line in mid position. If we consider the engine to be used exclusively for fast work, the valves should be designed to suit running conditions at some average speed, but without crippling the starting power. The compression line should, therefore, be governed entirely and only by the inertia of the reciprocating parts. The weight of the reciprocating parts on this engine is 540 lbs. on each side, and the ratio of connecting rod to crank is 7 $\frac{1}{2}$. We will confine our investigation to the back end diagram, Fig. 1.

In Fig. 2, line AB represents the accelerating and retarding effect, in pressure per square inch of piston area, of the reciprocating parts. Correcting the indicator diagram in the usual way we develop the new diagram MNOPQ, representing actual horizontal pressures (per square inch of piston area) on the crank pin. From this diagram it can be easily seen that a reversal of pressures takes place at O, two inches from the end of the piston stroke. The work represented by MNO is, therefore, positive work, and that represented by OPQ is, negative work and neutralizes an equal amount of work in the cylinder on the opposite side of the engine.

In Fig. 3, RESTUV, represents the inherent power of the steam in the cylinder under existing conditions, during the stroke under consideration. Of this power the sectioned area is not used, most of the unused portion being entirely available; the remainder is that represented by the indicator card, and is available for doing useful work.

From Fig. 2 we see that we can get more work out of the steam, and still cushion the reciprocating parts by lowering the compression line OQ. If we try to get it by means of more cylinder clearance only, the amount of clearance would have to be increased from 9 per cent.

to 20 per cent. of the total cylinder volume. Fig. 4, drawn under these conditions, shows the compression line thus depressed, giving no reversal of pressures before the end of stroke and showing the horizontal crankpin pressures, all positive. This has been accomplished at the expense of live steam. The area RR'VV' has been added both to the diagram representing total work and to the diagram representing unavailable work; therefore the per cent. of total inherent work available is diminished; also, the steam will have to be drawn from the boiler to raise the pressure of the volume of steam in the clearance space from X to R, or by 105 lbs. On the other hand, if we cut out the valve giving half an inch inside clearance, the compression line will begin considerably later than that shown in Fig. 4, ending at the same place. The exhaust begins earlier, but at a speed of 270 revolutions per minute the effect of this earlier opening will be so small as to entirely disappear.

Fig. 5 clearly shows these conditions. The per cent. of the total inherent power of the steam utilized has been increased, and the amount of live steam necessary to raise the pressure in the cylinder clearance to initial pressure is but nine-twentieths of that in Fig. 4. It is therefore, preferable to make cylinder clearances, including port passage ways only as large as absolutely necessary for the free flow of the steam, and if any further modification of the compression line is necessary, to effect the same by means of inside clearance in the valves.

K. effectual and lasting remedy will perhaps require more extensive innovations than any that have yet been seriously urged, and no traffic man is sanguine enough to believe that they will be made this year, or even next; but the discussion is bound to continue, and when the final and satisfactory solution of the problem shall have been reached, the New York Railroad Club, and Mr. Wheatley's Committee in particular, will have the just credit that always attaches to pioneers.

That committee lays down the following general and comprehensive principle as the basis for the discussion—a principle whose soundness and force will doubtless be more and more clearly recognized as time goes on: "The simple and natural solution of the large-car problem would seem to be the establishment of a rate unit for light and bulky articles that will make no discrimination between small and large capacity cars." This principle suggests, and probably requires, far more radical action than any recommended by the committee or taken by the club. Realizing that many difficulties surround any radical changes of classification, the committee very wisely decided to proceed slowly and gradually. Its specific recommendation was the amplification of a scheme of reform that has been approved of by numerous traffic officials, and is now under consideration by the various traffic associations, as follows:

"To limit the existing minimum car-load weights to cars of 34 ft. in length, inside measurement, and to establish a sliding scale of minimum weights, increasing for cars over 34 ft. and decreasing for cars under 34 ft. in length, upon the basis of the proportionate weights per foot of 34-ft. cars under the present minimum weights. For instance, when the minimum carload weight provided for any article, if loaded in cars 34 ft. in length, is 20,000 lbs., it is proposed to deduct 600 lbs. for each foot of length of car less than 34 ft., but not less than 30 ft. in length; cars under 30 ft. in length to be charged the minimum carload weight applicable upon cars 30 ft. in length. Likewise when the minimum carload weight provided for any article, if loaded in cars 34 ft. in length, is 20,000 lbs., it is proposed to add 600 lbs. for each foot of length of car more than 34 ft., actual weight to be charged for when in excess of the minimum weight."

This remedy for the prevailing difficulties was proposed at length by the Western Classification Committee in November, 1895, and, according to Chairman Ripley's report, appealed to the committee as a "simple and efficient solution" of a "troublesome transportation problem." The suggestion is that the present minimum weights be retained and applied to shipments loaded in and on 34-ft. cars, and that in the case of freight that is loaded in cars over 34 ft. long 3 per cent. be added to the minimum for each foot or fraction thereof in length in excess of 34 ft. outside measurement of the car; an analysis of nearly 1,100 cars weighed by the Western Weighing Association indicating that 3 per cent. per foot is the proper addition to make to cover the additional loading capacity in excess of 34 ft. This arrangement would amount to a graduated scale of minimum carload weights based on car lengths above 34 ft., the present minima, and 34 ft. being retained as the basis of the system. With a minimum weight of 20,000 lbs. an addition of 3 per cent. per foot amounts to 600 lbs. per foot, as stated in the previous paragraph.

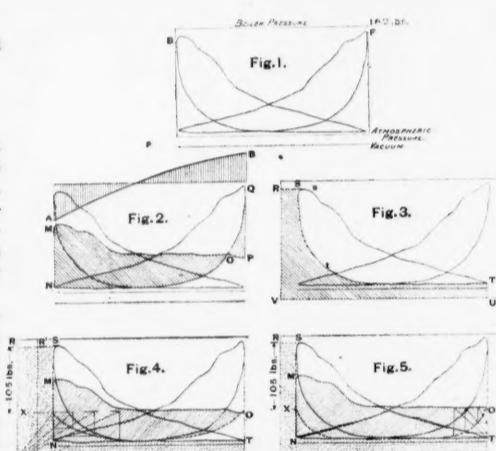
But this solution of the problem, which the Western Committee considered "simple and efficient," did not satisfy the New York Committee. The comment and the conclusion of this committee were as follows:

"The proposed sliding scale of minimum weights is based solely on the varying lengths of cars. It does not take into consideration the evident fact that cars of the same length often vary widely in their cubic capacity, the difference being in the width and height. From a traffic standpoint, in the handling of light and bulky freight, the width and height of box cars is of quite as much importance as their length. The committee is of the opinion that the basic factor of the sliding scale of minimum weights should be, not the length of the cars, but their actual inside cubic capacity, as suggested by Commissioner J. F. Goddard."

Upon this definite recommendation of a sliding scale of minimum weights based on actual cubic capacity the committee rested, so far as it discussed the large-car problem as a traffic problem, and its advice was earnestly seconded by the 90 expert members of the New York Railroad Club that were present at the February meeting, as has already been shown. The committee obviously did not consider this a radical change of the classification, and it would doubtless have admitted that its recommendation was rather tentative than final, falling as it did far short of its cardinal principle, viz.: the establishment of a rate unit for light and bulky articles that will make no discrimination between large and small capacity cars.

The committee seems to have been indebted to Commissioner Goddard for the substance and even the language of its proposal. Mr. Goddard apparently does not consider the solution of the problem so easy as it appears to Mr. Ripley, although his views are no less pronounced. He says: "From a traffic standpoint the question of the height and width of cars is as important as that of their length. In regard to the use of small cars now on hand, the question, so far as the public is concerned, is mainly as to their employment in loading light and bulky freight. The most equitable way to overcome this difficulty appears to me to be the adoption in our freight classification of a graduated scale of minimum carload weights, based on the cubic capacity of the cars. I am not unmindful of some, at least, of the arguments that can be brought against such a plan, but, all things considered, I believe that it is practicable and the most equitable plan to both the public and the railroads that has so far been suggested."

The views of Mr. Paul Wadsworth, Assistant General



to establish "maximum dimensions for freight equipment," and that this will serve the purpose "without material changes in methods or conditions as at present existing in the various classifications." That the sponsors for the existing classifications, minima and all, should think that their work cannot be improved upon, is, of course, natural; but Mr. Gill's views find little support in the pamphlet in hand. At the same time, those who have spoken have hardly agreed among themselves. To promote the end in view, let us bring together the various remedies suggested in the pamphlet, just as the diverse statements of the mischief have already been grouped.

To begin with, the weight of the numerous and able members of the New York Railroad Club, as declared by formal vote of the organization, has been thrown in favor of an "earnest recommendation" to the traffic associations "that in making their rates on light bulky freight, such rates shall be based on the cubic capacity of the car." Here is an authoritative demand for a "change in methods or conditions" that the classification committees will doubtless admit would be "material." In this demand is embodied what is perhaps the first decisive and well-marked step toward an "effectual, satisfactory and lasting remedy for the difficulties of the situation." In the discussion before the club, at all events, the late Mr. W. G. Wattson, then its Secretary, took occasion to point out, that, although the large-car question had been a favorite subject for discussion, the committee's report, on which the rate above referred to was based, was the first one to make a definite recommendation; while according to Mr. Gill, the Official Classification Committee "at various special meetings" had got no further than the conclusion that no material changes in methods were necessary. An

Freight Agent of the Delaware & Hudson Canal Company are substantially in accordance with those of the Western Classification Committee. Recommending the retention of cars of small capacity, Mr. Wadsworth explains that "a rule can be inserted in our classification fixing a percentage basis of increase upon the present minimums where the large capacity cars are used, thus affording the carriers the proper amount of revenue for hauling such cars, and also avoiding any complications arising from alterations in the classification of carload property."

Mr. E. C. Leavenworth, General Freight Agent of the Grand Rapids & Indiana, advances the same general ideas but suggests certain modifications in details. The use of 34 ft. as the basis for the classification he thinks would be an injustice. "Either a 40-ft. car should be taken as the basis for classification," he says, "or the minimum weights in the classification could be reduced for certain light and bulky articles, increasing the weights of all commodities loaded in large cars, using a certain percentage for each foot of increase in the length of cars." Mr. Leavenworth would make the minimum for furniture 10,000 lbs. for 34-ft. cars, and would add 300 lbs. for each additional foot in car length, which would bring the minimum up to 11,800 lbs. for 40-ft. cars, or practically the same as the present 12,000-lb. minimum.

So much for the various suggestions of graduated scales of maximum carload weights based on either the length or the cubic capacity of the cars. That any such adjustment is practicable, or even desirable, is denied in toto by the Official Classification Committee through its chairman, Mr. C. E. Gill. Mr. Gill's assertion, that the present system of minima is "more generally satisfactory" than any system "having for its object the equalization of the capacities of different sized cars" would be, has already been quoted. His enumeration of practical obstacles to the adoption of the remedy proposed by the New York Club, which includes that recommended by the Western Classification Committee, is no less positive. Referring to the opinion of the New York committee that "the basic factor of the sliding scale of minimum weights should be the actual inside cubic capacity of the cars," Mr. Gill denies that it is possible that the classifications will ever be so arranged. His reasons for this conclusion, apart from the dictum that the present scheme is "more generally satisfactory," are based mainly on the ground that any system of graduated minimum weights would involve enormous expense. Mr. Gill states his objections to the New York plan categorically at some length. They may be summarized as follows:

1. Under the proposed plan agents would be obliged to insert in salvo receipts and way bills the cubic capacity of cars loaded with articles subject to the varying minimum weights. This would require additional labor and expense, especially in the case of cars loaded on private sidings, or at points distant from stations. Additional clerical expense would also be occasioned at stations and junction points by the necessity for computing charges according to the varying minimum weights, and for entering and checking on way bills and transfer slips the cubic capacity of cars. The liability to error would be increased, and mistakes would be more difficult of correction.

2. Exact knowledge of the capacity of cars placed or

4. Commercial usage has fixed the existing minimum carload weights as units of quantity for the quotation of prices and the sale of various commodities, and the adoption of varying minimum weights would cause serious disturbance to commercial conditions by rendering indefinite and problematical what constitutes a carload.

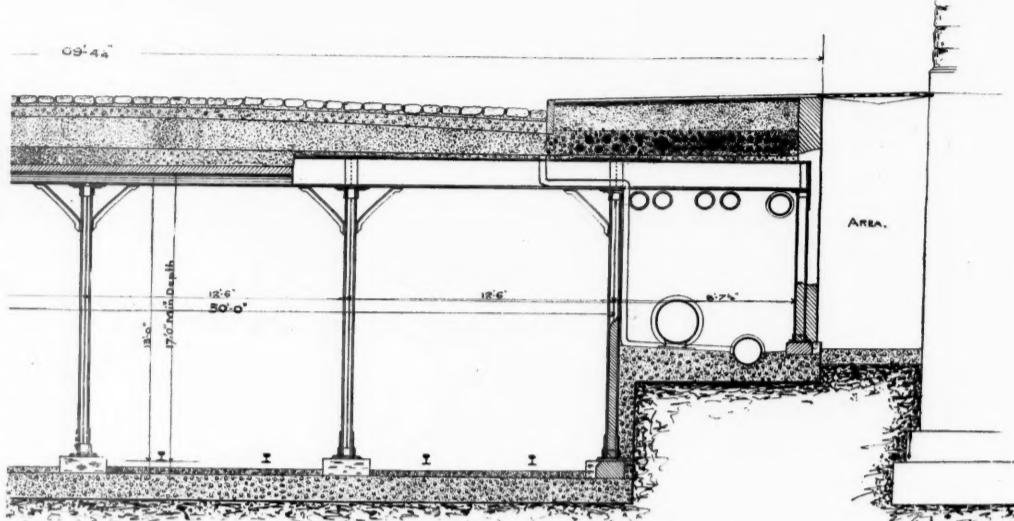
These definite practical obstacles to the adoption of the New York plan are obviously serious enough to demand careful consideration. As the question is one primarily of classification, an important step toward the adoption of a graduated scale of minimum carload weights will be to enlist the interest of the Official Classification Committee. But that committee, according to its present light, is inclined to deny that the classification "will ever be arranged" as Mr. Wheatley's com-

probably receive it at no distant day; and that the final solution of the intricate problem will doubtless be found in line with the simple, comprehensible and scientific principle laid down by the New York Committee, and already quoted, viz.: the establishment of a rate unit for light and bulky freight that will make no discrimination between small and large-capacity cars.

(TO BE CONTINUED.)

Rapid Transit in New York.

Last May the Supreme Court of the State of New York decided against the plan submitted by the Rapid Transit Commissioners of the City of New York. The basis of the adverse decision was that the Commission-



Rapid Transit Line, New York City—Elm Street Construction.

(Section of One-half of 4-Track Road.)

mittee desires. The New York remedy thus seems to be far from a permanent or even an experimental application.

Singularly enough the Classification Committee stands almost alone among those represented in the New York Railroad Club's pamphlet in advancing objections to the proposed system. Commissioner Goddard, as already quoted, says that he is "not unmindful of some of the arguments that could be brought against such a plan"; but, so far as appears, neither the large-car committee nor any official that joined in the discussion, except Mr. Goddard, is mindful of any arguments whatever against the proposed reform. The opposing arguments apparently, have not been advanced because they have not been discovered, and they have not been discovered because the investigation of the subject has

ers' plan would cost so much as to involve the city in obligations beyond the constitutional limit of its indebtedness. The Commissioners' estimate was \$50,000,000 in round numbers. In the opinion written by Justice Ramsey the statement was made that the city can now issue only \$36,000,000 in bonds applicable for a new rapid-transit railroad. Any expense beyond that could be met only by taxation.

On the 6th of August, 1896, the Board passed a resolution directing the Chief Engineer to submit general plans for a rapid-transit railroad to cost not more than \$30,000,000 "after abundant allowance for contingencies." The general route specified by the Board was from a southern terminus at or near the Post Office, under City Hall Park and Park Row, Elm street and Fourth avenue to or near the Grand Central Station; thence by two routes east and west, the western route to proceed under Forty-second street, Broadway and the Boulevard to a point above 125th street; the eastern route to proceed under Park avenue and over private property to the Harlem River, and beyond the Harlem River as far as the proposed limit of cost would permit. On the main stem this railroad was to have four tracks, and above that, two tracks on each route, with provision for a third track for express service "where conveniently and economically possible." It was provided also that the road was to be in tunnel except on the East Side north of Ninety-eighth street, and on the West Side at Manhattan Valley. The plans were also to provide for extensions from the southern and the northern termini and for four tracks eventually without unnecessary expenses or interruption of traffic.

On Thursday of last week Mr. Parsons, the Chief Engineer, submitted his report, and what follows is a free abstract of that report, verbal quotations being indicated by quotation marks.

There was no information at hand showing the material to be encountered in Elm street, and a series of borings was made, giving accurate information. These borings extended from the corner of Chambers and Elm streets to the corner of Fourth avenue and Thirty-third street. Above Thirty-third street information procurable from architects and builders and from the Department of Public Works has been considered sufficient for the present stage of the proceedings. Under Elm street the character of the soil is more variable than in Broadway, but it is with few exceptions a sharp silica sand ranging from good fine sand to coarse sand and gravel mixed, and it is "an excellent material in which to conduct such construction as is proposed." Much of the sand is of such building quality that it would pay the contractors to store and use it for the mortar and concrete required on the work.

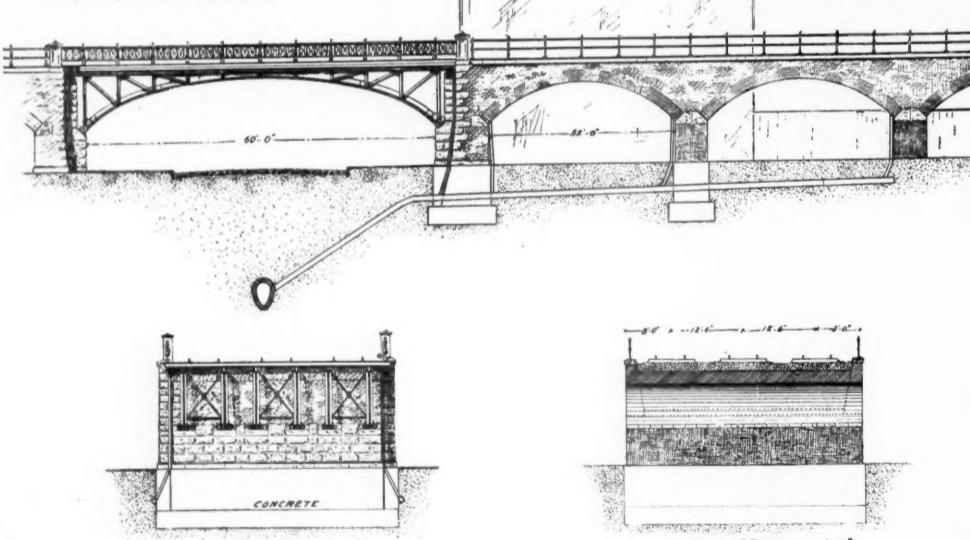
Rock is first met at Twelfth street and is found at or near rail level as far north as Thirty-third street. Above Thirty-third street, on both routes, a considerable part of the excavation will be in rock, but not more than was anticipated in the original estimates. The only part of the route where the rail level will lie below tide water is along Elm street for about 1,600 ft., the maximum depth below tide water being 5½ ft. The ground water in general was found to be about one foot above mean high tide.

Elm street lies nearer the dividing range of the city's

available for loading carload traffic would be required of superintendents, trainmasters and agents, in order that they might be able to fill orders for cars of specific capacity. This might necessitate radical changes in the established systems of reports of empty cars on hand. The distribution of equipment according to capacity might compel a complete reorganization of the methods of storing and handling cars, and certainly would occasion extra switching, a vast increase in switching expenses, and detentions in loading and unloading.

3. Shippers of articles subject to varying minimum weights would be required to designate the capacities of cars desired, or to bear the additional charges if cars of greater capacity than requisite should be used. This would result in friction, dissatisfaction, and endless contention, because the size of car required for loading a certain quantity of freight can not always be predetermined.

been superficial. The conclusion is, therefore, reasonable that the problem is still very far from solution; that the traffic experts are only just beginning to devote to it serious thought; that the harmonizing of conflicting opinions will be a slow process; that neither the conclusion of the Classification Committee, that the establishment of "maximum dimensions for freight equipment" will be an "effectual, satisfactory and lasting remedy," nor the vote of the New York Railroad Club, "earnestly recommending" that the rates on bulky freight be based on the cubic capacity of the car, settles the question; that the subject is worthy of the careful study of the keenest intellects in the transportation service, and, in view of what has been done already, will



Rapid Transit in New York.—Viaduct Construction Through Blocks.

drainage than Broadway does; consequently, disposing of the sewers will be a less serious matter. The Canal street sewer can be treated by cutting it where the railroad crosses and building a new sewer to the East River. The amount of sewage so diverted will be less

the pipes will be replaced on the construction of the new street. At Fifth avenue and Forty-second street the large Croton water mains are encountered, but here is a decided ridge, and in order to have good grades for the railroad it would be desirable to pass far enough

below the level of the avenue to leave the water pipes and gas pipes undisturbed overhead.

The proposed route escapes entirely the difficulties presented in Broadway incident to heavy traffic, cable railroads, special service structures and the care of abutting buildings. The work can be attacked at as many points as is convenient, and the whole rapidly completed.

The instructions propose 125th street as the northern terminus on the West Side, but this Mr. Parsons does not consider a satisfactory terminus, it being a point on the proposed viaduct over Manhattan Valley. If the line is extended to near 135th street it will perhaps reach the northerly limit of present profitable operation and will be carried complete'y across the viaduct and terminate at the surface, whence it can be readily extended north. Furthermore, the Third Avenue Railway Co. has a franchise for a cable or electric railroad to run to Yonkers, and with this line in operation the residents of those northerly regions can be brought readily to the 135th street terminus, whence they can take fast express trains to the lower part of the city.

On the East Side the situation seemed more perplexing. The line might be carried up Fourth avenue alongside the Harlem Railroad to the river, but this suggestion was strenuously opposed by the abutting owners. If the line be carried east of Fourth avenue it will come into close competition with the Second and Third avenue elevated roads, and the people of the neighborhood can be served at less expense and more immediately by improving the facilities of those roads than by building new ones.

Concerning the general principle of the relations of the new line to the old ones, Mr. Parsons says:

"In studying this question I have considered the existence of the elevated railroads, and have deemed that the best results for the city at large and for the parties who will construct and operate the Rapid Transit Railroad will be obtained by building the new railroads as far removed as possible from the present lines, leaving the latter free to take care of their legitimate traffic, but by improved and extended facilities if necessary. The business of the street railroads (including the elevated railroads) in this city is increasing at a rate twice and a half as fast as the population. The normal increase in traffic will not only provide a profitable business for the Rapid Transit road without drawing from existing lines, but makes it appear certain, if the past is any guide to the future, that at no very distant date both the existing lines and that proposed in this report will be insufficient to properly care for the travel. I have, therefore, endeavored to study out a location that will allow the new and old systems to be developed from independent territory."

Manhattan Island, which now supports a large population, and which is capable of supporting a still larger one, but which is wholly without rapid transit lines. This is the best field in New York City for creating traffic. It, therefore, instead of carrying

the eastward of it, it should be carried to the westward of Fourth avenue, it would be removed from the existing railroads and serve to create its own traffic, and at the same time provide rapid-transit facilities for a portion of this city's population which is now removed to an inconvenient distance from the elevated railroads."

A careful study shows that this region can be served by carrying the railroad up Fourth avenue to 110th street; thence along some cross street to Lenox avenue; thence along Lenox avenue to the Harlem River. Lenox avenue is the only available street, as Madison and Fifth avenues are prohibited by law, and the Seventh avenue line is too near an existing elevated line. Or, the new line could branch off at or near 110th street, pass through the rear of lots to near Lenox avenue, up far enough west of Mt. Morris Park to avoid the valuable property abutting on that square, and thence run north to the river parallel to Lenox avenue. By this plan the right of way would have to be acquired from 110th street to the river.

The prolongation of this line would reach the annexed district at about 150th street, and here the conditions are peculiar. The tracks of the surface railroads and the large yard at 161st street divide the region into two distinct portions; on the east side there being already a large population, and on the west a valuable region entirely without transit facilities. These two regions must be treated entirely independently of each other for transit purposes. The easterly region now has railroad facilities and the Manhattan Company has made propositions for improving these and for extending its suburban line, and also for building a new line well to the east of the suburban line and running as far north as Mt. Vernon.

"These extensions could be made at an early date and afford immediate relief to the populated portions of the Twenty-third and Twenty-fourth Wards, and if at the same time a third track were laid on the Third Avenue road, as the Manhattan Company proposed, and so enable it to run a continuous express service, the upper part of the city would receive almost immediately a fair rapid-transit service—much more quickly than it could by waiting for the Rapid Transit road itself. It would seem to be wise, therefore, to leave the district lying east of the Harlem Railroad to be served for the present by the improved facilities which can be afforded by the Manhattan Company. Should the Manhattan Railway Company refuse to extend and improve its service, it is quite possible to lay out and construct a new line into the east portion of the upper wards. The officers of the Manhattan Railway Company stated, however, that if they were compelled to build extensions through the easterly portion of the Twenty-third and Twenty-fourth Wards, they would find it a financial burden at the same time to construct lines through Jerome Valley as well. This latter extension could, therefore, be properly taken up as the line of the proposed Rapid Transit Railroad. It would be a direct northerly extension of the Lenox Avenue line and would secure for itself a large territory free from competing railroads."

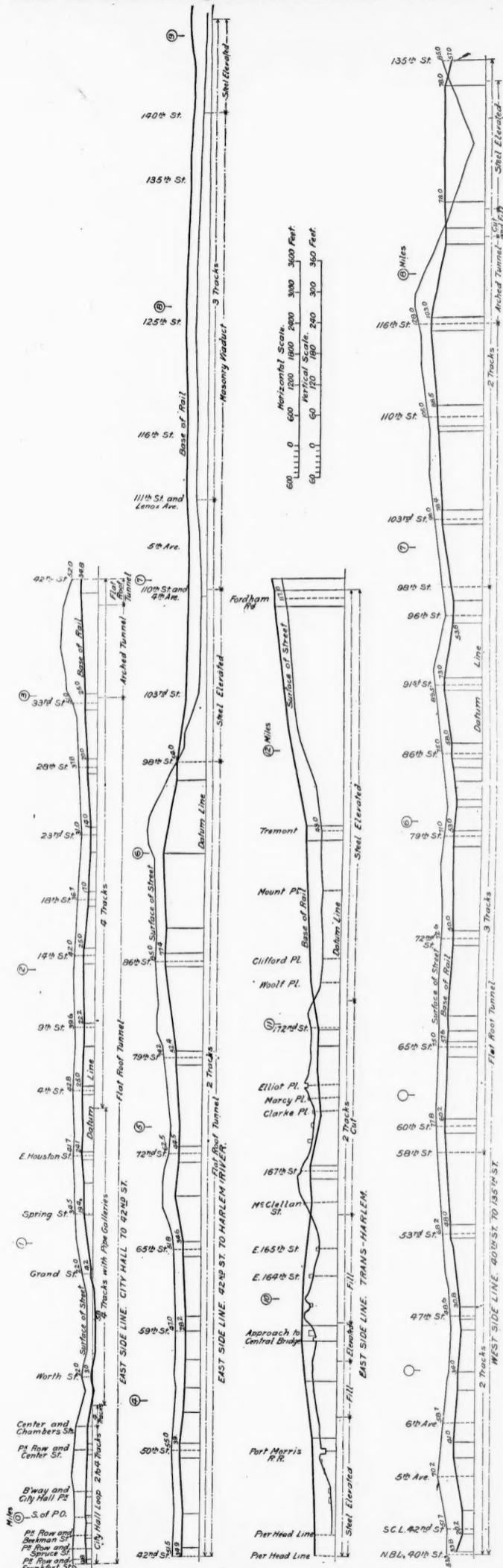
The plan proposed for this line north of the river is to acquire private property and build the railroad according to the topography; that is, an elevated road or depressed road, or running on a bank with retaining walls. For two miles this road could be built without interfering with the grades of cross streets, which could be carried over or under, and it could be built at a cost less than that of an ordinary two-track elevated road for the same distance. Beyond this two miles it would not be so economical to build on private property. The ground rises abruptly and tunneling for a long distance would be necessary. The wise plan would seem to be either to stop for the present at about this point, say at Tremont or Burnside avenue, and wait for the traffic to develop, or to run to the west to Jerome avenue and build an elevated railroad northward for $\frac{1}{4}$ miles to Fordham Road. It seems proper to stop now at Burnside avenue, although the engineer's estimate includes the cost of the work to Fordham Road. He judges that the additional outlay would be better spent in extending the southern end of the road from the Post Office to South Ferry.

A road from the Harlem River to Burnside avenue would be through a region of thin population, and two miles of railroad built into that region will prove its capabilities and possibilities.

The Board required four tracks as far north as Forty-second street. On the easterly line north of that point there is room only for two tracks on the west side of the Harlem Railroad, under or over Park avenue to 110th street. On the continuation of this line from 11th street northward to the Harlem River, the Engineer has estimated on a third track for express trains. A station at 125th street could be so arranged that an express train could either stop there or run through on the third track, and in the latter case it would have an unbroken run from a point about 1,000 ft. north of the Harlem River to Fifth avenue and 110th street, or over $2\frac{1}{4}$ miles.

On the West Side line the estimate covers a two track road through Forty-second street, up Broadway to Fifty eighth street, and a three-track road thence north to Ninety-eighth street. Stations at Sixtieth and Ninety-sixth streets can be arranged so that an express could stop at either or both of them, or could make a continuous run, without stopping from 103d street to Fifty-third street, $2\frac{1}{4}$ miles. Supposing, however, that the trains stop at 125th street on the East Side and at Sixtieth and Ninety-sixth on the West? It is believed that this schedule could be successfully worked: from City Hall to Forty-second street, $5\frac{1}{2}$ minutes; City Hall to 125th street, 21 minutes; to the north side of the Harlem, 24 minutes, and from City Hall to Fordham Road, .5 minutes. Or, by the West Side line, from City Hall to Sixtieth street, 11 minutes, and from City Hall to 135th street, 21 minutes.

With the report are a condensed profile, sheets of



than was proposed in the Broadway scheme; consequently, a smaller sewer may be built. No part of the route now contemplated is a main thoroughfare for water and gas pipes or electrical subways, and beneath Elm street there are no pipes of large sizes, and all of

typical cross-sections and a general map showing the route. The map and the profile we reproduce, as well as some of the cross sections.

The construction designs have been worked out only so far as to form a basis for estimates, but for the greater part of the route the construction would be in conformity with detailed plans previously made. Along Elm street pipe galleries have been provided for, but these galleries need not be as capacious as were those designed for Broadway. Along Lafayette Place and Fourth avenue, where the street is 100 ft. wide, the pipes can be carried on the roof of the tunnel or at the side.

The only radical change from previous plans is the viaduct portion through the blocks north of 110th street, and a typical design of this structure is shown on one of the drawings. It is suggested that on private property the viaduct should be of brick arches supported on concrete piers, with steel arches across the streets. The arches are designed to give 12 ft. head room at the curbs and 14 ft. in the middle of the road, which is more than the minimum clearance of the Manhattan.

Although this construction would cost considerably more than ordinary steel elevated structures, it could be economically maintained, carry the heaviest traffic, be almost noiseless and be slightly. The design is closely allied to that of the famous Stadtbahn, in Berlin, one of the finest pieces of city railroad construction in the world.

South of the City Hall station would be a complete loop, to avoid switching or crossing of express or local trains. This would probably be carried around the Post Office, giving a station on Broadway. Cable pits would compel the line under Park Row to be depressed, and probably the Post Office station would be a few feet lower than the ordinary stations, leaving the pipes in Broadway undisturbed. Two tracks are planned to serve the Post Office, giving direct and constant communication with the Grand Central Station. Tracks for the storage of trains and so forth can be provided. A special track might be laid to serve the newspapers, permitting them to load their morning editions directly from the pressrooms through vaults under the sidewalk. Cars so loaded could be taken to the Grand Central Station in five minutes by express trains, saving over half an hour.

In estimating on these new plans the cost of real estate had to be considered, as much private property must be acquired. Profiles covering all the routes have been prepared, with the stations located. Quantities and unit prices have been carefully determined. The total mileage contemplated is:

Two-track.....	10.90 miles
Three-track.....	3.99 "
Four-track.....	3.03 "
Total.....	17.92 miles

It is believed that the work as described, with terminals and storage places, can be built for \$20,048,000, with an allowance of \$1,200,000 for interest. An allowance of 20 per cent. for contingencies is recommended. From Fourth avenue avenue to a point near Lenox avenue an estimate has been made for a right of way 25 ft. wide, enough for two tracks, this to be taken from the rear of lots abutting on 110 street. Northward from 110th street the minimum estimate of right of way is 40 ft. and the maximum 50 ft., according to the lot lines. Forty feet would be sufficient for three tracks. North of the Harlem, a right of way of 50 ft. has been assumed. At two other points property will have to be acquired, namely at Ninth street and Astor Place, to reduce curvature, and on Park avenue, where the line emerges from the tunnel to the viaduct. The actual value of the real estate, determined after careful consultation with experts amounts to \$3,000,000, making the total cost of the railroad complete \$24,248,000, adding a large amount for contingencies gives the outside estimate of \$29,097,600.

Street Railroad Trucks.*

BY JOHN N. AKARMAN, Superintendent, Worcester Consolidated Street Railway Co.

When motors were first placed upon street cars, it was believed that there was no necessity for special construction, or any marked departure from the prevailing horse-car practice. The idea of a separate truck had not even been conceived. We found Vandepole placing his motors upon the front platform, and using chains and sprocket wheels to carry the power to the axle. The car carried the whole weight of the motor and load, and in addition to its usual work, took all the strains of the propelling power. Sprague made a short step in advance and in the right direction by carrying his motor on links from the car body and resting one end through sleeves on the axle. This improvement preserved the distance always the same between the motor and the axle, but the rising and falling of the body imparted a racking motion to the motors, which was destructive to the cars. Both of these systems were radically wrong. The idea of a separate truck was first conceived about the year 1885, but it was not until the latter part of 1887 that, in its concrete form, it was put into operation.

The first truck consisted of a continuous upper cord made of bar iron in the form of a rectangle. Its purpose was to support the car body, the sills of which rested on its frame. The sides of this upper cord were re-enforced by heavy oak sub-sills to which the cord and the pedestals were both firmly bolted. This form of frame kept the body square and took many of the strains on itself, but it has been abandoned, and in abandoning it and using separate bars, we have been drifting away from the best practice, for it had a very important advantage in preserving the squareness of the body and truck. In addition to this upper cord, there was a bar extending around the truck to which the bottom of the boxes were fastened.

In all the early trucks, the frame rested directly on the

journal boxes. The jar and concussion which resulted crystallized the metal, injured the motors, and made it impossible to keep bolts and nuts tight, and was the cause of a rapid destruction of the whole truck. A remedy became an imperative necessity, and cushioning was resorted to. The first effort in this direction was made by placing a thick piece of rubber upon the top of the journal box between it and the axle box frame. While the principle was right the means employed was of little value. Then a spiral spring was tried upon the

of ample diameter and length to carry the load with ease and have sufficient motion. Thus placed, they had the advantage of carrying the box perfectly steady, preventing entirely the rocking and unsteady motion. These motors were carried on the truck and were in no way attached to the car body or connected with its motions.

The brakes were first suspended from the sills of the car, and the sinking of a body under a load left the shoe so far from the wheels that in applying the brakes the slack of the chains was increased and could not be taken up without considerable delay. The remedy was simple and consisted in suspending the brake rigging from the axle box frame in such a way that it was not subject to the action of the body springs.

The change in the brake rigging from the car body to the truck frame brought another evil which had been of slight importance heretofore. This was the longitudinal rocking or pitching of the car body, technically known as galloping, which was greatly increased under higher speed, and is also further increased by lengthening the car bodies. This motion is not only excessively unpleasant to passengers, but very destructive to the trucks, motors and track. When the brakes were hung from the car body it was possible to check this oscillation by a slight application of the brake, but the change in the hanging of the brake made this impossible. The first thing that was done as a remedy was to increase the wheel base, but this did not prove to be of much advantage. The first success as a remedy appears to have been made by extending the sides of the truck, and on the extension pieces mounting an elliptic or half-elliptic spring. The latter method with the half-elliptic spring has been the most successful preventive tried.

As experience was gained it became more and more evident that a motor truck was a locomotive in every sense of the word, and for success must be governed in its construction by the general principles involved in the construction of a locomotive. The greatest difference between the functions of a motor truck and a locomotive seems to be the fact that the motor truck carries the load instead of drawing it. It is moved forward by the revolutions of its axles, and is subject to combined vertical, horizontal and twisting strains of the most severe kind, and at the same time it must ride as easily as a carriage. It has been demonstrated that a composite truck frame is a failure, because of its inability to stand all the strains imposed upon it. The braces, which were amply sufficient to carry the weight, give it no strength to resist twisting strains. As a result of the best information and from large experience, I believe the ideal four-wheeled truck for electric cars is one having the fewest number of parts in its construction, in which the sidepieces of the main frame are single forged bars connected across the ends by bars either bolted or welded on so as to make the frame one continuous piece. This frame is carried by springs, from the journal boxes, and itself carries an upper cord, likewise a continuous rectangular piece which has suitable seats for the springs. This upper cord is recessed to take the bolts and spring seats, and leaving its upper surface flush. The ends are carried by the half-elliptic springs, while the spirals are placed at the journal boxes. The brake should be hung by links. On account of the motors diagonal bracing is out of the question in the construction of a truck, but the diagonal strength is usually increased by the introduction of transoms. Taken at its best, the four-wheeled truck is an uncomfortable carriage and a veritable track destroyer, and should only be used, according to the best judgment of many of our wideawake railroad men, where cars are run at comparatively slow speed, and with moderate length of car bodies. Where it is desirable to run at higher speed in suburban service, the damage to the track becomes so great that it should preclude its use. The increased length of wheel base made necessary makes it hard on curves.

The only alternative is to use a double-truck car with swivel trucks. The advantage of this form of truck is very great. The conditions, however, are not altogether in favor of the pivotal truck. As, for instance, if all the weight is used for adhesion it is twice as expensive in use as a four-wheeled truck. If two motors are used, it only has 50 per cent. of the propelling power. In its ordinary form it makes a wide body necessary, and hence is out of place in narrow streets or places where traffic is very heavy. It also has the disadvantage of putting the body at a greater height than is necessary with four wheels. However, it meets a great many of the requirements for fast suburban service, but the objection which I have just mentioned precludes its use in many cases where it would have otherwise been desirable. Now, the remedy for nearly all of these objections has been found in what is known as the maximum traction truck.

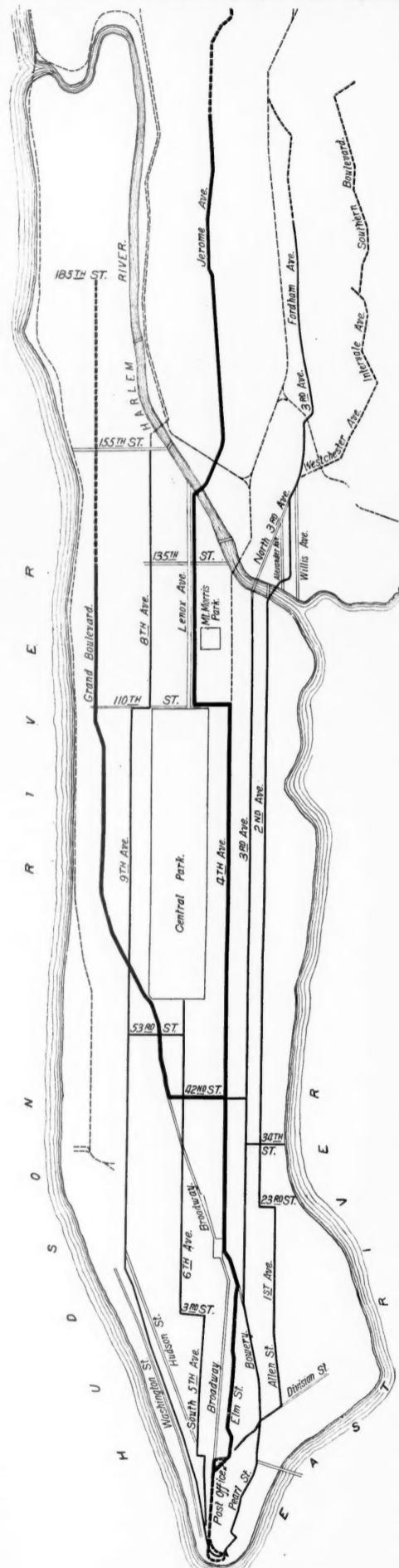
The maximum traction truck may be defined as a pivotal truck in which the load is eccentrically placed in relation to the four wheels; two of them receive only a sufficient amount of weight to keep them upon the track, while the others take the remainder of the load. In practice it is found that 80 per cent. of the weight may be placed on the driving wheels, while 20 per cent. is used for guiding. Upon applying these trucks it was found that it was not necessary to have the wheels of equal size; that a large pair of driving wheels and a small pair of idle wheels can be used. The large pair used as driving wheels being very near the pivotal point have a comparatively small amount of swing, and can be allowed to rise within the floor timbers, while the small wheels moving through a much greater are easily clear the sills. By this form of construction, the body cannot only be brought down, but the frame can be made as narrow as in the ordinary street-car body. This form of truck enables the car to be utilized for both street and suburban service. It is also found in its latest form utilized under long open cars. It carries the motors in a satisfactory manner, guides readily and answers nearly all the requirements of the service.

As inter-urban service is almost equivalent to that of the steam roads, for this service, pivotal trucks having regular swing beams, equalizers, elliptic springs, and all the parts of the steam-road truck are entirely satisfactory. They take curves easily at a high rate of speed. But for trucks which must run not only on trams, but on T rails, some form of the maximum traction truck will give, all things considered, the best service.

In conclusion, let me call attention again to this very important question to be considered in connection with the adoption of single and double trucks, which is, whether the punishment to the track by single trucks is not so great as to more than make up for the cost of putting in and running double trucks under cars of all lengths of bodies, whether short or long.

A Home-Made Locomotive at Thetford Mines, Quebec.

The accompanying engraving shows a locomotive owned by Bell's Asbestos Company, Limited, which is in use at the company's mines, at Thetford, in the Province of Quebec. It is used to haul waste rock from the quarries to the dump.



OUTLINE MAP OF THE ROUTES PROPOSED FOR
RAPID-TRANSIT SYSTEM OF LINES FOR
NEW YORK CITY.

(With the Report of Mr. W. B. PARSONS, Chief Engineer.)

* Abstract of paper presented at the St. Louis meeting of the American Street Railway Association, Oct. 20-23 1896.

This locomotive was made at the works in Thetford, as a matter of economy, as the cost of a Porter or Baldwin locomotive of the same size, with the tariff duty of 35 per cent., would have cost in the neighborhood of \$4,500, while this one was built at a cost of only about \$1,500, including \$400 for the boiler, which was made by the Jenckes Machine Co. of Sherbrooke, P. Q., and making an allowance of \$400 for the pair of engines. The engines are a pair of Copeland & Beacon's hoisting engines, the frame of which had been broken; the drum was removed and the engines drawn closer together, forming a saddle for the boiler to rest on, where the drum-shaft passed through.

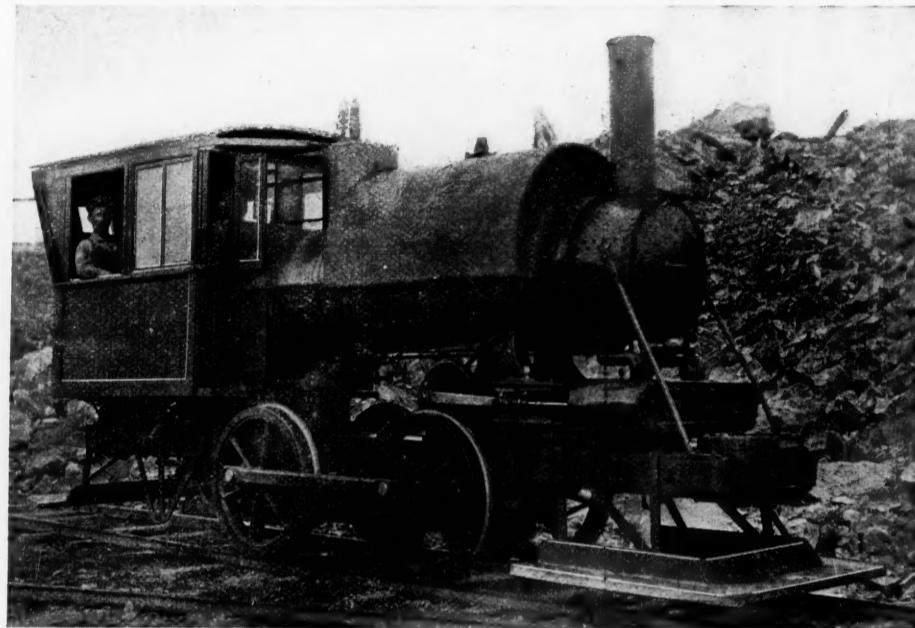
The wheels are of cast iron, cast in Sherbrooke and finished at Thetford, and the tires were purchased at Pittsburgh, Pa. The diameter of the wheels is 36 in., and the wheel base 4 ft. 6 in. The cylinders are 7 in.

Several hours were spent examining the works at this point, those of chief interest being the water-power development from which the arsenal shops are furnished power. There is an available head of water of about 8 ft. Ten large turbines drive a common shaft and the power is distributed by a rope drive to the various shop buildings. This drive is wholly out of doors and the power is transmitted about one-half mile. An extension of the present water power is now under construction.

Rock Island Bridge.—The party was then taken to the new bridge over the Mississippi River, now in process of erection by the Chicago, Rock Island & Pacific, and the United States government between Rock Island and Davenport.

We show an outline of the new draw span, besides the masonry plans of the fifth pier.

This is the third bridge which has been built on the



Locomotive at Thetford Mines, Quebec.

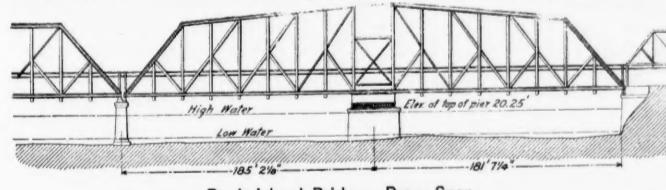
diameter, with a 12-in. stroke. The length over all is 14 ft., the extreme height 9 ft. 10 in., and the weight about 15,000 lbs. The tank has a capacity of about 240 gals.

There is a 10-in. pinion on the engine-shaft, which meshes with a 30-in. gear, on the forward driving axle. The connecting rods are two pieces of 1½-in. steel, with a piece of hardwood fitted between. The frame is made of two pieces of maple, with strap-iron on top and bottom, 1 in. × 6 in., which makes the frame very strong and stiff.

The hauling capacity, on a level, in tons of 2,000 lbs., is over 450 tons, and the engine runs at a speed of 12 miles an hour, hauling 10 3-ton empty cars, and makes a total of over 60 miles a day.

The locomotive has been in service for three years, during which time there have been practically no repairs made, and from present indications the next three years will show very little cost for wear, outside of turning down the tires. Forty-pound rails are used on the main line, and on the sidings and switches, 25-lb. rails.

The asbestos of this district is found in a belt of serpentine extending through the eastern townships of the Province of Quebec, which accompanies the Cambrian slates. The rock comes to the surface at Thetford on the Quebec Central Railway, and again at Danville on the Grand Trunk. At the latter place an isolated cone, 75 acres in area, rises from the bottom of the valley, all a deep bottle-green serpentine rock, and almost one solid mass of asbestos. There is hardly any waste, the entire rock being fibrous when broken up and ground.



Rock Island Bridge—Draw Span.

At Thetford the serpentine rock appears as a long ridge with veins of asbestos running through it in all directions. The rock itself is dead. Waste grounds are consequently a necessary adjunct to the quarries, and at some of them the dumps have reached such proportions as to justify building this locomotive to maintain a regular train service.

An Excursion of the Western Society of Engineers.

A party consisting of 175 members of the Western Society of Engineers left Chicago, Saturday morning, Nov. 7, for Rock Island by special train, furnished by the Chicago, Rock Island & Pacific Company, and was taken by train to the Government Arsenal, situated on Rock Island, in the Mississippi River. The island has an area of 960 acres.

The live loads for which the bridge was calculated are:

Trusses:
Railroad floor, 4,000 lbs. per foot on each track.
Roadway deck, 80 lbs. per square foot, or 3,360 lbs. per lineal foot of bridge.

Total moving load, 11,360 lbs. per lineal foot of bridge.

Floors:
Railroad floor system—Lehigh heavy grade engine, 126 tons.

Cooper's diagram.
Roadway floor—Cooper's class "A."

The principal departure from common practice has been made in the railroad floor. This is composed of four lines of stringers spaced 6 ft. 3 in. centers and covered with a solid corrugated steel floor, 26 ft. wide. This floor is watertight and protects the roadway floor below, weighs 940 lbs. per foot of bridge including steel guard angles and rail plates. This floor makes a very efficient lateral system in which the trough sections carry the shear due to wind pressure and the continuous rail plates under the rails act as chords and carry the bending moment.

The draw span is operated by means of a sprocket chain which engages the teeth of a circular steel rock. Vertical shafts, one on either side of the bridge, drive the chain, while the shafts are driven by an electric motor placed in the house at the top of the draw span. The electric wires are encased in iron pipes and strung along the top of the bridge. On the draw span they are supported by a turntable so that they do not interfere with the operation of the bridge, the bridge turning under them. From this point they are carried down into the house.

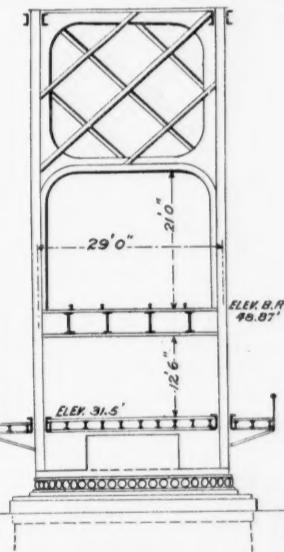
The devices for holding and locking the bridge when closed are operated from the house by compressed air, and the locking device is interlocked with the Hall signal system. An electric annunciator in the house enables the operator to know the portion of the operating parts at all times, and in addition the levers in the tower interlock with each other, so that they can only be used in the proper order and manner. The air compressor is also in the house on the draw span and is operated by electricity. Storage air tanks are provided having a total capacity of 200 cu. ft. The air pressure maintained is 130 lbs.

The People's Power Company, of Moline, Ill., furnishes power for the bridge at night, and the Davenport & Rock Island Street Railway Company during the day.

All electrical apparatus and all lifting, swinging and locking machinery was installed by G. P. Nicols & Bros., of Chicago.

Saturday and Saturday night the party were the guests of the Chicago, Rock Island & Pacific and were entertained at the hotels in Davenport. Sunday forenoon they were taken by Col. Wm. R. King, Corps of Engineers, U. S. A., by steamboats to visit the Mississippi River improvements and the Hennepin Canal locks. These locks were designed and constructed under the supervision of Major W. L. Marshall, Corps of Engineers, U. S. A.

The canal when completed will connect the Mississippi River with the Illinois River, joining the latter at a point below La Salle, Ill. This work was commenced in 1892, and is being carried on by the United States government. Between 14 and 15 miles are now completed,



Section of Draw Span.

one. The railroad floor is also 26 ft. wide in the clear and has a head-room of 21 ft., or practically 5 ft. more than the old one.

The superstructure consists of:

1 fixed span	26 ft. 9 in. long, weighing.....	338,000 lbs.
1 draw	365 " 7 " "	2,466,000
2 fixed	258 " 0 " "	3,299,000 "
3 " "	216 " 6 1/4 " "	3,691,000 "
1 " "	193 " 3 " "	789,000 "

Total weight of superstructure.....10,583,000 lbs.

The length of the bridge over all is 1,850 ft. The material used is all medium steel excepting where cast iron is used for bed plates, and except the rivets, which are soft steel. The shop work is punched and reamed, and all sheared edges planed. All other details of the shop work have been carried out according to the best known practice.

leaving about 61 miles unfinished. The estimated cost of the whole work is \$6,800,000. The canal will be fed from Rock River, the dams, locks and controlling works being completed at this end. The normal width of the canal is 80 ft. and the depth 7 ft. The locks are single and constructed of concrete, being 35 ft. wide and 170 ft. between gates. The gates are operated by hand. Mr. L. L. Wheeler, Assistant Engineer, U. S. A., accompanied the party. As he has had charge of the work from the beginning, he was able to point out many interesting features. The party were entertained at dinner, Sunday noon, by the Empire Portland Cement Company, through their Western Sales Agent, Mr. C. E. Schaufler, a member of the society.

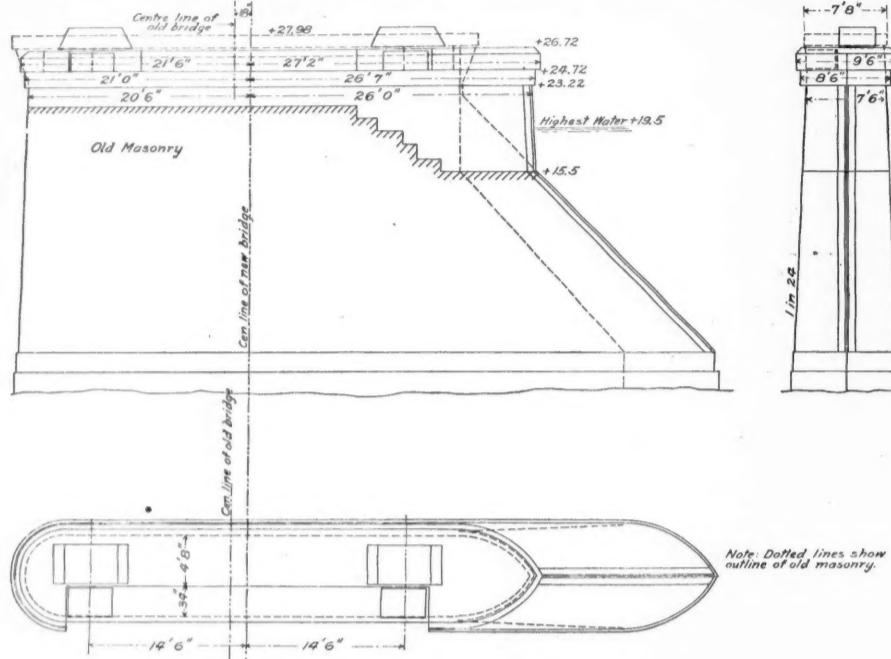
A Fast Run.—The Chicago, Rock Island & Pacific on the return trip made the distance, 181 miles, between

Rock Island and Chicago, in 3 hours and 30 minutes which included several station stops and crossings where speed had to be reduced. This is the best record made between these points where so many stops were made. The train consisted of the new engine No. 1,101, recently illustrated in the *Railroad Gazette*, and four day coaches. A number of miles were made at a speed exceeding 75 miles and hour.

The Smart Flush Car Door.

We illustrate by the accompanying engravings a new flush car door for freight cars, which is made by the Smart Car Door Company, Nashua, N. H.

Fig. 1 shows a front view of the door when closed,



Rock Island Bridge—Plan Showing Alteration of River Pier V.

Fig. 2 shows sectional views both when open and closed and Fig. 3 shows a top and side view of the track over the doorway at the front and back ends, the door and door attachments being shown by dotted lines. It will be seen that the door is carried between guides at the top and bottom, and is hung from grooved rollers which run on a straight track, C (Fig. 3). On the under side of this track is a flange A, which engages two lugs B B, one on either side, which lugs are portions of castings D, attached to the door at the front and back. This flange is bent inward at the front and back of the doorway, so that when the door is pushed, the flange guides it, by means of the lugs, into place, and it is closed flush, both ends at the same time by one operation only. To allow the door to close flush the axles of the hangers are loose in the wheels, thus permitting the use of a straight track.

The track construction over the doorway is such that the door cannot become derailed, and when closed it is held, independent of both bottom guide and hangers, by a gravity lock, shown in Fig. 1.

The special features of this design are the straight track, the doing away of all mechanisms such as toggles, springs and cleats, and the fact that both ends of the door are closed at the same time by a single operation. The application of these fixtures to a car door does not require the cutting away or weakening of the door or car frame, and they can be applied to old as well as new cars without changes in the car or door proper.

This flush car door was exhibited at the Master Car Builders' convention at Saratoga in June, 1896, and received much favorable notice.

Car Heating by Steam.*

An inquiry among those having charge of equipment on cars shows that success is almost universal, and almost all trouble can be either traced to lack of steam circulation in the train pipe, or to insufficient attention to the drips or traps.

Train pipes as used for all couplers should have their ends conform to the Master Car Builders' position for direction and location. . . . The end of the train pipe should be placed above rather than below the standard position. The train pipe should drain from the point where the car supply is taken off its ends. . . . Such train pipe cocks should be used as are readily understood on sight. . . . In service all train-pipe cocks but one, the rear one, are to be open, and in cold weather the rear one should be open enough to let just a little steam escape through it so as to maintain a circulation of steam throughout the train pipe, whether or not the rear cars are using steam. . . . The covering should be applied to the train-pipe, otherwise it will not stay on. . . . As to the amount of direct steam-radiating surface in a car, experience has led to the use of two 2-in. standard iron pipes along each side. . . .

For direct steam an automatic trap for discharging the condensation is not necessary or desirable. Angle valves are usually used for drip valves, and in many cases have been so arranged as to prevent their being entirely closed. Experience has taught that it is better not to so arrange them. A very simple and safe

method of adjusting the drip valves properly was given by Mr. A. M. Watt before the Central Railroad Club. He instructs to just touch the hand to the drip valve, and if the hand can be borne on it and it is warm, it is all right. If it is so hot that it burns, it is too far open; and if cold, it needs to be opened a little. . . .

It is desirable, in conjunction with water circulating systems, to use some kind of a device for discharging the condensation, which device shall be in a degree automatic.

Mr. Dixon's rules and specifications were given in our issue of Oct 16.

DISCUSSION.

MR. GOLD (Gold Car Heating Co.): I should not consider that the success attained by steam-heating systems has been quite so universal as a perusal of the paper under discussion would imply. . . . The perfection of a

All train-pipe valves should be left open, and the one in the rear car closed tightly; because, a train-pipe valve being automatic, and having a trap attached, it will itself release the condensation and allow as free a circulation of steam in the last car as in the first.

I deem it inadvisable to have a man open the cock of the rear car, because he is liable to open it too much and waste considerable steam, or, if he does not open it enough, the condensed steam moving slowly is very liable to freeze the pipes at the end of the car. . . .

I heartily disagree with the writer of the paper when he says that "for direct steam an automatic trap for discharging the condensation is not necessary nor desirable."

Not only are many thousand cars on several of the leading railroads in this country equipped with traps, but every car which has thus far been fitted with steam heat in Great Britain, as well as many more on the Continent of Europe.

With a trap the discharge of condensation is taken care of automatically and completely, and a trap is, therefore, in my judgment, far better than a drip valve. . . . With a hot-water circulating system there is at first a great deal of condensation, and I deem it necessary to have an automatic trap, for the purpose of quickly discharging this condensation, which trap should not be automatic in a degree, as called for in the paper, but thoroughly automatic in all its features. It seems to me that the nearer automatic a system is, the more general will be its use, and any apparatus which requires the continual attention of the trainman to drip valves, which are located either outside or inside the car, is, in my mind, very unsatisfactory. The train hand should have little else to do for the steam heat but to open or shut the supply valves for the admission of steam. . . . With a good automatic trap there is no danger whatever of steam escaping to damage the floor of the car or destroy the varnish. In Mr. Dixon's rules for making up the train, he says: "All cocks in the steam train pipe the whole length of the train should be left open." Now, then, when a train pipe valve is used, all should be left open except the one in the last car, and this one should be closed tightly, for, as before explained, it is automatic, and will itself take care of all condensation at that point, and naturally there is no need of a man bothering with the rear car thereafter.

In changing engines, the steam should be shut off at the locomotive, and the train-pipe valve in the first car closed. In this way the train will be kept warm for some little time, by keeping all the steam in the radiator pipes, and if the cars are to go out of the station again in half an hour or so, they will still be comfortably heated. If, however, as the paper says, you open the cock on the rear car, then all the steam leaves the train, and the cars will cool off quickly, requiring a much longer time to get them heated when steam is again turned on. Here again is found the advisability of the use of an automatic steam trap.

The paper says, that when cars are laid up, or stand 30 minutes after engine is uncoupled, the hose throughout the train must be uncoupled, and all drip valves and blow-off valves opened; but, when a coupler is supplied with an automatic relief trap, all this trouble of uncoupling is obviated. Continual coupling and uncoupling every time steam is shut off for 30 minutes, and also when cars are laid up, will, in my mind, injure the steam hose very considerably. Furthermore, in case the matter is neglected, there is the very serious liability of frozen couplers.

MR. BARBEY (Barbey & Co.): Mr. Dixon says: "When signal is given steam should be turned on at the cab not to exceed 65 lbs." Also he states in the next paragraph: "After steam issues at the rear end of the train pipe the rear cock of last car should be closed, and reducing valve in cab set to 40 lbs. pressure." I would like to ask Mr. Dixon if he allows his engineers to send through the rubber hose 40 lbs. of steam.

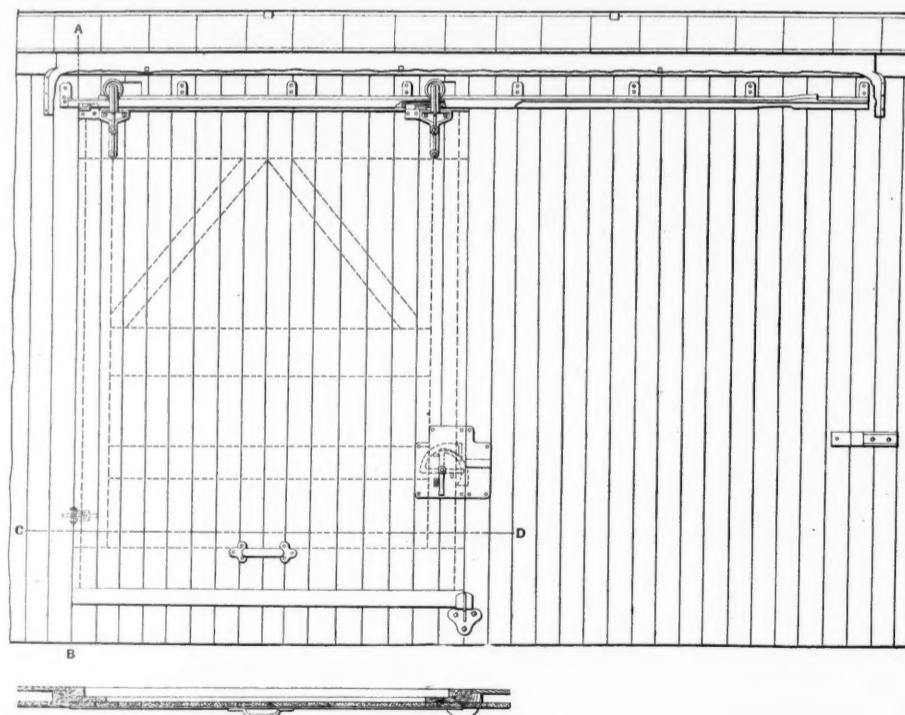


Fig. 1.—Smart Flush Car Door.

liable to strike the switch tracks: but then again, if too high, it will bring the steam couplers up too near the air-brake coupling and have a tendency to uncouple the latter.

The disadvantage of train-pipe cocks is that after some usage they are liable to stick and become inoperative, and on this account a train-pipe valve which is much simpler in construction and very easy to operate, besides being automatic and self-draining, has found very considerable favor with many railroads. . . . It is almost impossible to repair a cock when it gets out of order, and generally when trouble occurs they have to be replaced; consequently, in using two straight-way cocks there is twice the cost for maintenance than there is with one cock, and very considerably more than when a train valve is used.

MR. MITCHELL (Erie Railroad): I will answer the question, as Mr. Dixon is not in the railroad service. On the Erie Railroad we made an exhaustive series of tests to demonstrate how much steam was required per car in a train. We found on the first three cars it required about 4 lbs. to each car. We found after that you should add about 5 lbs. additional per car for about five or six cars, and then you would have to increase the pressure about 7 lbs. per car for the balance of the train. We found that the steam would not go through 20 cars with less than 80 lbs. of steam. We therefore set the pressure to be carried on our trains as follows: The pressure should not exceed 50 lbs. on the locomotive and train pipe unless called for by the conductor, in which case the pressure could be run up to 75 lbs., beyond which our safety valve on the train pipe in the engineer's cab would not permit.

* Abstract of a paper by Mr. R. M. Dixon (Safety Heating & Lighting Co.) and of the discussion of it before the New York Railroad Club.

Mr. BARBEY: If the manufacturers of rubber hose were notified that there was that difference, that the railroads were to use 75 lbs. of steam to heat their trains, they would meet all the requirements in manufacturing a hose that would not harden. The trouble is that the rubber companies do not understand just what the railroad companies want. If they want a hose to remain flexible under 125 lbs. pressure the rubber companies can produce it, but you have got to pay better than 56 cents per foot for it when they do. The rubber companies can produce a hose that will be as flexible as a kid glove under any pressure. As I stated before, manufacturers do not know what is required. And then there is no need to heat with 55 to 60 lbs. pressure when you can heat a six-story building with 5 lbs. I know of a building heated with 1 lb. of exhaust steam. The reason why we cannot keep the train pipe clear of water is that the trainmen are not paid for that kind of business. They do not know when it is required to blow the train pipe out and they are always trying to heat water with steam.

Mr. MITCHELL: I have listened very attentively to what the last gentleman has said, and I am surprised to learn that the Boston Belting Company has not known what the railroads require in steam-heating hose, unless it is because they have just begun to furnish the Boston railroads that have just introduced steam heat with hose. We have been in the steam-heating business about eight years, and have used 50 to 75 lbs. pressure on our train pipes during that time. It was about six years ago that I made the test where it required 80 lbs. of steam to blow the steam through a train of 20 cars. Now, if Mr. Barber can put 1 lb. pressure of steam through a train, he has my permission to come over to the Erie Railroad and try it on our direct steam cars.

Relative to our system, on our road we use two train-pipe valves. We place our steam pipes, well fitted, between the deafening ceiling and the floor, so that the pipe is not exposed. It is then covered with asbestos and mineral wool. We formerly placed the train-pipe valves in the center of the coach, but found that when the valves broke it cost us a good deal of money to repair; but two years ago we introduced the practice that every time a valve broke we would apply the train-pipe valve under each platform with a stem coming up through the platform floor, so that it could be operated from the platform by an extension on the top end of the valve. By this means we have overcome a great deal of the cost of repairs, and we have found that two train-pipe valves are better than one three-way cock, located inside of the car, on account of the readiness with which it can be repaired. We also found, after two years' experience with an experimental train-pipe valve, that a $\frac{1}{16}$ -in. hole drilled through the plug in such a way that when the valve was closed live steam would blow out through the $\frac{1}{16}$ -in. hole into the atmosphere, would allow sufficient escape to prevent any condensation from freezing between the last train-pipe valve and the rear end. With this arrangement we have reduced the cost of maintenance very materially, and have also simplified the care of the rear train-pipe valve by the trainman. They do not have to change it after it is once started. Mr. Gold remarked that in changing engines it was only necessary to close the valve on the engine, and the train-pipe valve on the first car, and allow the steam to escape through the gravity traps. We have on our road gravity traps, but still insist on blowing out the entire train-pipe before reaching a terminal where the engine is to be changed, for the reason that some inspector might "cripple" a car, which would require cutting it out, and to prevent any delay to the train we take the precaution to blow out the entire train pipe. Where the time of changing engines is not over three or four minutes, no serious delay or trouble would occur in condensation or cooling off of the coaches.

At the request of the President I will state that we have been using steam heat about eight years. During that time we have had cars freeze up, have had no end of trouble; in fact, have had the usual experience; but about five years ago we went into the subject very carefully after having seven or eight cars freeze up, to ascertain the cause and see if we could not introduce some remedies or rules to prevent such occurrences. After looking into the question thoroughly we introduced the rule that trains approaching division terminals where engines are to be changed or division terminals where the train is to be put away, that ten minutes before reaching such terminal the trainmen should go through the train and fully open every supply valve; that five minutes before arriving time the rear train-pipe valve should be fully opened. As soon as the

trainpipe is opened wide, the engineer immediately notices on the train-pipe gage that the steam pressure has fallen, and he leaves the steam on the trainpipe for about two minutes, when he closes the main valve on the engine, not disturbing the reducing valve. Since these rules have been in effect we have reduced our trouble to a minimum. I would further add that just before a train gets to the terminal, after the train pipe is blown out, the trainman also opens the blow-off cock in the trap and relieves all the traps from water.

We have stationary heating plants at our terminals; hence, we do not allow a coach to become cool, unless it goes to the shops for repairs. I might add, in relation to traps, I am a firm believer in traps under the cars. The traps save a great deal of trouble, and I believe in a great measure prevent freezing of train pipes, and also

prevent the excessive heating of the trains. Without traps the trainmen always keep the temperature too high for fear the pipes will freeze up.

Mr. MORRIS (Chesapeake & Ohio): I do not believe we had a failure of steam heat last winter, with the exception of when the cars were in a very severe blizzard in the North, and became disconnected everywhere and anywhere, and there was not attention enough paid to them; but on our own road proper we did not have a failure. We have at all terminals arrangements for heating the cars when detached from the engine. We have no less than six or seven systems on our road. . . .

have in the coaches, and the Sewall drum and McElroy comulgler. We have them all attached to the same trains.

Mr. WEST: You are able to heat those mixed systems with 40 lbs.?

Mr. MORRIS: Yes, indeed. I do not think the system cuts any figure. The radiating surface in the car does the work. The practice on our road is almost the same as with Mr. Mitchell. It allows in an emergency 75 lbs. pressure to be applied, but as a rule we get along with 40 lbs., with a top limit of 75 lbs.; but this is only for extraordinary cases of emergency.

Mr. MITCHELL: With seven cars we would use over 30 lbs. pressure. On train No. 3 we often have 14 cars; 12 cars is the regular train, and we use 50 lbs. of steam, except as the conductor orders 75 lbs.

Mr. DIXON: Referring to Mr. Morris' remarks regarding low steam pressure, he has already stated that he has stationary plants at all terminals, and his cars are kept warm when out of service. Now, it is a very different thing to maintain the temperature in these warm cars from what it is to heat up a train of cold cars. The reason that high steam pressures have to be used is not because so much more steam is used, but because it is almost impossible to get a pipe larger than $1\frac{1}{4}$ in. under the cars, and in order to force sufficient steam through this for a long train, high pressures have to be used.

I happen to have the data of the test Mr. Mitchell speaks of, and of another test of direct steam-heating of 10 cars connected with straight train pipe and $1\frac{1}{2}$ -in. full port couplers. With 20 lbs. turned on at the engine after one hour, no pressure had reached beyond the seventh car. The radiating pipes in the car were cold at the start.

Regarding the opening of the rear train-pipe cock in very cold weather, Mr. Mitchell's remarks bear on this. They drilled a hole through their train-pipe valves. The rules suggested were not for any special system. There are probably 11,000 cars in the United States that have no traps on their train pipes, and in cars without traps on train pipes, if the supply to the rear can be closed off, the train pipe becomes dead ended from the supply to the next car forward using steam; and unless the train-pipe cock can be opened, the condensation in the dead-ended portion of the train pipe will settle to the couplers and freeze.

There is a question I would like to ask Mr. Mitchell. I understand he has specifications for a test for steam hose, and I take it he has samples of each lot received after it is tested. I would like to ask him whether the hose remains in the storehouse until they have approved it or not.

Mr. MITCHELL (Erie Railroad): About six years ago our purchasing agent asked me to make tests of several different makes of hose and ascertain which was the best. . . . I rigged up a rubbing machine to rub the hose against the other, under a pressure of 70 lbs. of air. I set the machine going and found that the chafing life of the hose varied from two hours in one case to twenty hours in another, so I reported to the purchasing agent the twenty-hours hose was the best and the two-hours the poorest, and we continued to purchase hose on this test. Later on I found that this test was not worth so much as the guarantee of the manufacturers for two years, and therefore we have abandoned the chafing test on our road.

Mr. WEST: I am glad to hear what Mr. Mitchell says about accepting the hose on the guarantee of the manufacturers. When the purchasing agents tell the manufacturers how to make rubber hose it is about time to stop. I think if the railroad companies put the rubber companies on their honor they will have less trouble.

Mr. CULVER (New York, Ontario & Western): We carry on our road from about 40 to 50 lbs. pressure usually in cold weather. We use nothing but the common globe for a drip valve. We have two cars with automatic drips on, which we find are very good. We shut off the cock on the front end of the train on approaching a station where we change engines, and hold the steam all on the train, which we find is a very good thing to do as we do not take so much steam from the engine again in charging the train pipe. Then we open the train pipe valve which carries off the condensation. Have never had any trouble with condensed water in the pipes. I do not know anything more that I can say on this subject.

Mr. HAYWARD (Pennsylvania Railroad): The system in use on the Pennsylvania Railroad is the return system, and in our service in moderate weather we heat our trains almost entirely with exhaust steam, having a pump on the engine to produce a vacuum in the return pipe.

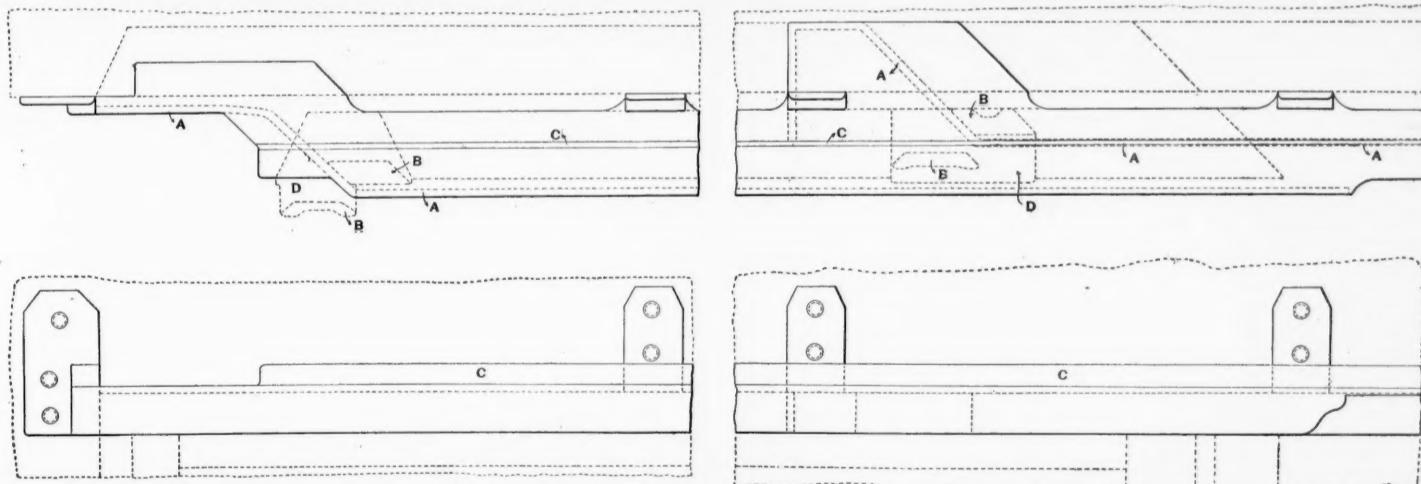


Fig. 3.—Plan and Elevation of Track—Smart Flush Car Door.

rear-train-pipe valve is opened wide, the engineer immediately notices on the train-pipe gage that the steam pressure has fallen, and he leaves the steam on the trainpipe for about two minutes, when he closes the main valve on the engine, not disturbing the reducing valve. Since these rules have been in effect we have reduced our trouble to a minimum. I would further add that just before a train gets to the terminal, after the train pipe is blown out, the trainman also opens the blow-off cock in the trap and relieves all the traps from water.

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The PRESIDENT: I think the members would like to know what pressure Mr. Morris uses on his trains.

Mr. MORRIS: The length of the train, of course, makes a deal of difference. Our through trains have a maximum of 10 cars, in the winter nothing over nine, in the spring and fall we frequently have 10 cars; but we never use over 40 lbs. pressure, and after an engine has been changed and 40 lbs. pressure has been put back, we reduce that to 25 and carry 25 lbs. over the road with 10 cars. Of course, with less cars in the train we use less pressure.

Mr. MITCHELL: Were they direct steam or hot-water circulation?

Mr. MORRIS: We have direct steam in the baggage cars, and hot water in the other cars. This is the Safety Car Heating and Lighting Company's system that we

think in severe weather we rarely exceed 10 lbs. pressure, and generally work in moderately cold weather with 5 lbs. pressure, depending upon the length of the train. Of course, the return system is somewhat more expensive than the direct system. The pumps are an additional expense, and the principal trouble we have had is from the pump valve stems breaking; but otherwise we consider it a very successful and an economical system of heating trains, on account of requiring so much less steam from our engines.

Mr. MORRIS (Chesapeake & Ohio): I would like to have an expression from some of the gentlemen as to which system is preferable with them, whether the hot-water circulation or the direct steam.

(Continued on page 793.)



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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN OPINIONS, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

In our issue of Oct. 30 we had occasion to mention the forgetfulness of an engineman which caused a disastrous collision, and, as in so many cases of negligence, the precise circumstances under which the lapse of memory occurred could not be described in detail. But nothing is more patent to the railroad operating officer than that mental failures of this kind are almost always explainable, at least in some degree. The assumption, so often accepted, that the blunders of experienced enginemans and conductors are inexplicable and cannot be prevented, does not hold good. An illustration of this has just appeared in the British Board of Trade report on the derailment at Preston, July 13, at midnight, where one of the London & North Western's fast passenger trains bound for Scotland, drawn by two engines, was derailed by running about 40 or 50 miles an hour over a 12-degree curve. This report is by Lieutenant-Colonel Yorke. He takes three columns to tell what the newspapers at the time stated in three lines—that the train was running too fast, and that the schedule of 105 miles in 112 minutes (56½ miles an hour) was such as to encourage enginemans to disregard the regulation requiring the speed to be reduced, at this particular point, to 10 miles an hour. We do not mean to say that the length of this report makes it uninteresting, but most of the space is taken up with what was already known. The special point we wish to emphasize, however, is that the error of the enginemans was not so bald and mysterious as it might at first seem. In the first place the speed-limit rule had been habitually disregarded, and no one had been censured for it. In the second place, neither of the two enginemans had ever run this train before the night in question, and each of them had an engine which he had never run before. One of them had only once before run a train through this station without stopping, and that was two or three years ago, and the other had run through only two or three times. Therefore, as Colonel Yorke says, these men, "new to the engine, new to the train and aware that the company laid particular importance on the train's punctuality, allowed their anxiety to keep to time to overcome their discretion." Both were experienced men bearing high characters. Of course, they disregarded the fundamental rule of looking out for safety before speed, and probably consciously, and they are censured accordingly. Their error "verges on grave recklessness." The inspector also says that a check rail should have been provided on a curve so sharp as this (less than 660 ft. radius).

This and other similar cases illustrate how we first make a rule and insist on its being obeyed to the letter; how then we see that conformity to its spirit will be sufficient, and finally tolerate disregard of the letter, forgetting that an intelligent comprehension of its spirit is a far more difficult matter than conformity to a rigid rule. Any man can keep down to "10 miles an hour," or at least have the reputation of doing so, especially where he can stretch it to 25 and still be safe; but in allowing the speed to be increased to somewhere near the limit of safety, we

place dependence on the engineman's good judgment, and the fact that the "good judgment" of locomotive runners is the product of long experience, not only on that particular line, but often on a particular engine, at a particular hour, is forgotten. The London *Engineer*, discussing the report on this derailment, thinks that if the engines had had trucks in front, like American engines, they would not have run off the track. The rigid wheel base of each engine was 15 ft. 8 in. We are glad to see the merit of the swiveling truck thus recognized, but we do not believe that passengers familiar with the Preston curve, and who read this report, will have any desire to traverse that part of the line at midnight at 40 miles an hour, even with a bogie engine. It appears that the curve at the beginning is right-handed, of 858 ft. radius, and this is immediately succeeded by a left-handed curve of 660 ft. radius, increasing in severity to one of 462 ft. This ugly reverse curve is not a relic of the early days of railroading; it was made about 1878, when one of the main tracks was slewed around so as to obtain space for an island platform.

A correspondent asks our opinion of the proposition, lately advanced in the "Train Dispatcher's Bulletin," to carry green signals on the last section of a train, instead of on all sections except the last. This would necessitate carrying green flags or lights on the engines of all regular trains not followed by a second section, and thereby largely increase the use of green signals on passenger trains. A prominent road is said to be considering the advisability of making this change. The argument in favor of such a change is obvious. Under the present arrangement an inferior train waiting on a sidetrack and looking anxiously at the engine of a passing superior train for an indication that the road is clear, finds that indication—an indication of safety—in the absence of a flag or light. Safety should be positively indicated; not, as in this case, negatively. The accidental extinguishment or obscuration of a light may give a wrong indication and cause a collision, as has occurred before now. The argument against the proposed change is equally obvious; a green flag or light should not be used here to indicate safety, while in other places it indicates caution. If green is to be used as a caution signal the most natural remedy for the defect in the present arrangement would be to have the last section carry some other kind of signal. A white flag or light would be appropriate; and there would be no difficulty in using white on regular trains, for its use on extra trains could then be abandoned. We have a strong aversion to white flags, because they are not only dirty, but very dirty, almost universally. How a road that spends hundreds of dollars on flower beds can at the same time allow its engines to flaunt greasy rags in passengers' faces, we cannot understand. But enameled metallic white or colored disks could be used in place of flags and could be easily kept clean. If it is too revolutionary to run extra trains without any classification signal, two white signals, or three, where now one is used, would readily meet the difficulty. With a satisfactory signal for the last section, the use of green signals on the preceding sections could be abandoned or not, according to individual preference, and no harm done; and the practice on roads using the new arrangement would not be inconsistent with that of the roads continuing the old way. The use of glass figures in the caboose, or metallic figures on the headlight, to indicate train numbers, is a rational arrangement, which does away with all perplexities about flags, and roads which use such figures seem to like them; but as their use does not spread, it must be concluded that the superior simplicity of the flag and light is generally regarded as too great an advantage to be given up. Our own recommendation is to adopt the block system (in which term we include, of course, the electric train staff). Then the right to the road would not depend upon the ability of a sleepy trainman to wake up in five seconds and make an unerring observation of the front of an engine passing at 60 miles an hour.

Probably it is not too much to say that there has never been, in our history, a revival of business so sudden as that which took place last week. It began the morning after the election, and in one day the feeling of the whole country changed from doubt and fear to confidence and energy. Perhaps it would be too much to say that there has never before been a change so general in the short space of 10 days. Some of the particulars—only a few, however—we give elsewhere. It is sufficient now to say that the change is felt in all departments of industry and business. Money has been released, interest has fallen, loans are easy to make, prices of securities have risen and everyone who has anything to invest is

looking for investments. All Europe was interested, and there was a universal expression of relief, over the civilized world, at the demonstration that the great republic is not bankrupt in all that goes to make a nation endure and progress. But are we too sanguine? Is this only a passing reaction, and shall we promptly sink again into "hard times" as we have done after the two or three little revivals of the last three years? This depends largely, mostly we should say, on the wisdom of our rulers. It seems if our difference of opinion with England is in a way to be settled with credit to both sides, and as if the settlement would be such as to strengthen the confidence of the Anglo-Saxon peoples in their own ability to get along without fighting each other. There remains, however, a foreign complication of considerable danger. It is not probable that the President will do anything indiscreet in Cuban affairs. But there is some apprehension that Congress may precipitate a war with Spain. We lately heard a high officer of the government express the opinion that this is the greatest danger now before us. A war, even with a power so weak as Spain, would, in the present condition of our Treasury, so embarrass us that there would be great danger of our going on to a silver or even a greenback basis. If we escape this peril we may reasonably hope for some years of prosperity, during which the present impulse toward sound financial legislation may give to Congress the courage and the wisdom to legislate the country out of the banking business. The cloud of uncancelable government notes, redeemable in gold on demand, still hangs over business, liable to precipitate a panic at any time that foreign exchange is sufficiently unfavorable. When these are redeemed, or funded, the vicissitudes of business will be reduced by the removal of a hazard which no individual can foresee or avoid. If the greatest popular majority ever given by this people means anything, it is surely an overwhelming declaration for the inviolability of contracts, and for a stable currency; but, as a matter of politics, or political possibility, history teaches that taxation for the redemption of these notes, or the interest-burden assumed by funding them into bonds, will be endured or permitted only in times of prosperity, such as we believe are now at hand. It is the hour of our opportunity.

Rapid Transit in New York.

On Thursday of last week, the Chief Engineer of the Rapid Transit Commission of the City of New York presented to the Commission a report of a new plan for a rapid-transit route for the city. An abstract of this report, with map and profile, and some typical sections, appears elsewhere in this journal. It is not our purpose now to attempt any elaborate inquiry into the merits of the plan, which strikes us as being well considered and a good and adequate scheme, under the conditions which limited the Engineer.

Of course everybody is familiar with the objections to departing from lower Broadway, but the Commission specifically instructed Mr. Parsons to take a route along Elm street and Fourth avenue. The Commissioners had very good, and probably entirely sufficient, reasons for leaving Broadway. The last plan which they brought forward was upset by the decision of the court, because of its cost, and it was necessary for the Commission to lay out a route which could be covered within the constitutional limit of indebtedness of the city, and which would yet serve its purpose reasonably well.

The route along Elm street runs parallel with Broadway at a distance of about 400 ft. This means a walk of about 1½ minutes. This might or might not be a large percentage of the time required by any one person to get to a station, but we doubt if that distance alone would deter many people who would otherwise have used the new railroad if it had been on Broadway. The new road will still be nearer to Broadway than either of the existing elevated railroads. So far as Broadway is concerned, the real competition is with the cable road. For the traffic going some short distance (no one knows exactly what distance) the cable will always have the great advantage that a passenger does not need to go to a station but can take a car at the nearest street corner. But if a man's journey is so long that he will walk to a station in order to get a train faster than the cable cars, the added walk of 1½ minutes to get over to Elm street, will probably not deter him in the great majority of cases. The amount of traffic that the proposed road would lose by going off from this portion of Broadway is entirely a matter of speculation. But at any rate there is no use now in entering into a theoretical discussion of this part of the problem. The question was to find a line, probably useful, on which the road could be built for the

money that the city could command for such a purpose.

We should suppose that it would be a misfortune to have the southern terminus of the road as far north as the General Post Office. The region below that latitude receives and discharges an enormous daily traffic and the revenue to be got from this traffic can ill be spared from the new road. This Mr. Parsons recognizes in his report, but he had to start here, according to the instructions under which he worked. He, himself, suggests leaving for the present some of the northerly portion of the line calculated rather to develop new territory than to serve that which is already built up, and spending the money thus saved on the lower end of the route.

We have been especially struck by the pains which have been taken to lay down the new line with careful references to its relations to existing lines of travel. For instance, the surface road to be built from 135th street to Yonkers can be made to feed the new line on that side of the city and save interest and working expenses, until the probable returns from a further extension of the rapid transit can be better estimated. On the East Side, the territory that can be most cheaply provided for by the existing railroads is avoided and an independent territory is invaded.

Another point of particular interest is the proposal to carry a portion of the line from the latitude of 110th street, and on northward, through private property. The financial aspect of this proposition is considered at some length in the Engineer's report, and from what seem to be sufficient data he comes to the conclusion that it could be done without unreasonable first cost considering the saving of damage claims. Surely this is, on general principles, an extremely desirable thing to do whenever it is practicable.

As noted above, underlying this plan is the general principle of recognizing the existing lines of communication and laying the new lines so far as possible to supplement the old lines rather than to compete with them. Of course this principle can only be followed to a limited extent, but it has long seemed to us that it was a vital one, and that it had not been always kept in mind by the projectors of new lines. There, is however, one practical difficulty in the way of applying the principle in the great uncertainty as to the future action of the Manhattan Company. That company has yet to establish confidence in its foresight, and in its good faith in the propositions that it has made.

New York as a Grain Exporting Port.

The position of New York City as an exporting market for grain is the subject of an article in the New York *Journal of Commerce*, which tells more plain truth than all its previous articles on the subject combined. The reason why New Orleans, Newport News and other ports have gained export grain business at the expense of New York must be looked for in a number of different factors, not the least of which is the greater volume of general business on the roads delivering grain at New York, which makes them much less anxious than the Chesapeake & Ohio, for instance, or the Illinois Central, to carry grain at the very small profit now obtainable. Another point not touched upon in this article is the difference between percentages and absolute quantities. This is not of much importance, but it seems to affect the views of the complainers, making differences seem greater than they really are. When the corn crop is heavy there is, of course, much more to send to Europe than when the quantity raised affords a smaller surplus above home consumption; and New Orleans took good quantities of corn for export as long ago as 1880. In such a year New York's percentage is reduced, while its absolute volume of business increases. But besides the foregoing, there are numerous perplexing conditions which seem to the grain men more readily curable, though it is by no means certain that they are curable.

The *Journal's* article is brought out by the opening of the railroad of the Brooklyn Wharf & Warehouse Co., on the east side of New York Harbor, which company proposes to transfer grain directly from railroad cars to ocean vessels, the cars being carried to its wharves by floats across the harbor. All of the railroads terminating in New York deliver cars of merchandise at many points by floats, including a number of places in Brooklyn, but this is the first time that bulk grain for export has been dealt with in this way. The Warehouse Company has already made a contract with the Lehigh Valley, but whether any other road will send export corn to Brooklyn is a question not yet settled. Under the ordinary custom, grain for export, coming to New York by railroad, is unloaded from the cars

into an elevator, from that transferred to a lighter and taken to the side of an ocean vessel, and there transferred by means of a floating elevator. The reporter does not seem very enthusiastic over the new Brooklyn arrangement, the company's facilities for loading still being insufficient to load a vessel in less than six days, whereas at Newport News and New Orleans the job can be done in two days. The lighterage of grain from the railroad elevators to the side of an ocean vessel is paid for by the railroad companies, and is included in the through freight rate from the West; but the charge for transferring the grain from the lighter to the ocean vessel is 1½ cents per bushel, and the reporter wonders whether the new Brooklyn establishment will do the work for any less. The cost of carrying cars on floats to a Brooklyn wharf ought to be considerably less than the cost of transferring grain to a lighter and taking it to an ocean vessel, the distance being, on the average, probably about the same. Besides the work of transferring, proper, the Brooklyn company will have to maintain switching engines to take the cars from the floats and place them in position at the elevators.

The *Journal* says that one reason why large vessels will not go to the elevators of the railroad companies at New York to load grain directly is that the slips adjoining the elevators have not sufficient depth of water. The railroads might dredge them out, but they say that they cannot afford to do so because the bulk of the grain going to Europe from New York will, in any event, be taken by the steamers of the regular lines, which could not be induced to come to the elevators.

Why grain steamers will not come to New York more than they do is not fully explained, but it appears that at the Southern cities the port charges are less, free wharfage being granted at some places. Then, again, it is an advantage to use cotton for a part of the cargo, and that commodity is generally much more readily obtainable at Southern ports. The grain steamers get practically no westbound freight whatever, so that for them New York has no advantage over Southern ports except perhaps a little in distance, and in winter this is neutralized by the desire of the vessels to sail the southern course to avoid ice. Vesselmen are generally ready to make contracts giving shippers the choice of any one of several Southern ports.

But the worst disadvantage of New York is that, under the present railroad tariffs, which, by all lines, are pretty close to cost, New Orleans has an advantage, so far as southwestern grain is concerned, which New York has not been able to overcome; and as the ocean freight rate is practically the same as from New York, this difficulty seems insurmountable. A more uniform and reliable grade of grain is generally to be had at New York, but this is not enough to induce a buyer to pay two or three cents more a bushel, which is said to be the advantage possessed by New Orleans. At the latter city the elevators, owned by the railroads, are leased by the merchants, and the cost of transfer is included in the merchants' selling price. How much of this is really borne by the railroad and how much by the merchant, no outsider knows. Summing up the comparison between New York and New Orleans the *Journal* finds the following results:

Corn Free on Board New York.

Market price of corn at Chicago Nov. 7.....	28½c.
Lake rate to Buffalo or Erie.....	2½c.
Rail rate, Buffalo or Erie to New York.....	5c.
Charges transferring to steamer at New York.....	1¼c.

Cost free on board, New York.....

37½c.

Corn Free on Board New Orleans.

Market price of corn at St. Louis, Nov. 7.....	26½c.
Freight rate St. Louis to New Orleans.....	6c.
Charges transferring to steamer at New Orleans.....	1¼c.

Cost free on board New Orleans.....

31½c.

Cost free on board New York.....

37½c.

Difference (if ocean freight rate is the same) in favor of New Orleans.....

3¼c.

The rate named from St. Louis to New Orleans, six cents per bushel, presumably is the rate by water. Whether the railroads take corn at the same rate, we do not know, but if they do it is equal to only three mills per ton per mile, reckoning the distance by the Illinois Central (708 miles). New York gets most of its grain from Chicago and Duluth, at which places the price is, it will be seen, two cents higher than at St. Louis.

This article brings up the standing complaint that although Philadelphia has, on account of the shorter distance, a lower rate on grain from the West than New York, New York has no advantage over Boston, and besides this matter of the freight-rate proper, the elevators of Boston, owned by the railroads, are constantly giving free storage for long terms, whereas

the New York railroads do not grant any such favors.

This Boston-Philadelphia grievance is a real one, but it is difficult to see what the merchants can do about it. Their only argument is that based on distance, but the distance from Chicago to New York, by way of Albany, is less than 6 per cent. below the distance to Boston, which makes a difference of only about seven mills per bushel of corn. This may be enough, of course, to turn the current of trade; but, on the other hand, the railroads leading to Boston can afford to fight strenuously for the retention of their present traffic. They have their elevators to maintain, but have little other business for them; while, on the other hand, the New York Central doubtless has considerable use for its elevators in New York City, even if the export trade were to be withdrawn. And the profit in carrying corn may very likely be too small to induce the Central to build additional elevators in New York City, where land is very costly. Again, the Boston & Albany is a very rich road, and can afford to carry grain at a very small profit. A road which pays good dividends, whether it has export trade or not, can afford to be very independent in its negotiations with competitors. All this has no bearing on the effrontery of Philadelphia in demanding her differential of two cents per 100 lbs., but, as we have remarked in previous discussions on this subject, what can New York do about it? For that matter, what can she do with Baltimore or Newport News? In this connection we may remark, however, that the most encouraging thing for New York that we find in the *Journal's* account is the statement that there is no freight from Europe for the Southern ports. As long as this remains true New York's merchants will not go to the poor-house. The Illinois Central people have been promising New Orleans that they would work up an import trade for that port. How much they have actually done we do not know. Galveston has lately been crowding over a shipload of jute butts for St. Louis, shipped to Galveston from India.

The New Master Car Builders' Axle for 80,000-lb. Cars.

Engineers and students have no doubt been surprised to find that a committee of intelligent railroad men has been willing to recommend a reversing and repeating fiber stress of 22,000 lbs. per square inch for a new car axle regardless of the material, whether of wrought-iron or steel. But as the committee did not mean exactly what it said in the report there need be no concern about the strength of the axle when compared with other axles already in service. The committee said:

"Your committee has concluded therefore, that if the new axle is designed using the strains as found by Reuleaux's method, and if a fiber stress of 22,000 lbs. per square inch is taken for the portion of the axle between the wheels, and the material provided in the specifications is used, a safe design will be the result without much surplus material. . . . Your committee may say that if its foregoing conclusions are accepted it follows that a design of axle which, under all conditions of repeated straining, keeps a fiber stress within the natural elastic limit of the material will be a safe one, so far as danger of breaking is concerned. . . . It has been stated that Wöhler found that for an unlimited number of reversals of strain, the fiber stress may safely be taken at 17,000 lbs. per square inch for iron and 23,000 lbs. per square inch for steel. But as his experiments were made with small specimens, and as axles are subjected to various stresses, apparently not included in his investigation, it would seem best to look into the fiber stress of axles in service and see what can be learned."

So far as we can learn from the report the Committee ruled out Wöhler's tests entirely, and in effect says that applying Reuleaux's formula to axles already in service and doing good work, and practically free from breakage when made of ordinary material, it is found there is a calculated fiber stress according to Reuleaux's formula of 23,000 lbs. and therefore it feels safe in going forward with an equal fiber stress calculated in the same way for the new axle. In other words, the other M. C. B. Standard axles correspond in dimensions between the wheels pretty nearly to Reuleaux's formula, and the new axle is made practically in the same proportions to load as the other M. C. B. axles. This fact is, however, hidden under a large amount of very interesting analysis and data within the report.

So far as we can see no attention is paid in the conclusion to Wöhler's results, nor do we get from the report any conclusion as to the actual repeating and reversing fiber stress to which axles are subjected, and, therefore, no one can criticise the design of the axle from the fiber stresses given for it, as they are simply nominal, not actual. There is no reason to believe from anything given in the report that the axle is not strong enough for the work it will have to do; in fact, the method followed in its design

practically makes it in the same proportion to the load as the other M. C. B. axles, and there is every reason to believe that it will give equally good results if properly made, of the right sort of material. However, as it is a larger axle more care must be exercised in manufacturing to secure uniformity of material and homogeneity of structure.

Those who have not read the Committee's report carefully in detail may be struck with the apparent complication of the mass of formulæ given. When, however, the formulae are transformed a little they become simple, and it is clear that within the limits of car design in this country the formulae give results that are practically proportional to the total weight of the car.

Take the formula for the stress between wheel hubs as an example; it is

$$M = \frac{Wb}{2} - \frac{Hh}{m} (x-b) + \frac{Hh_1 x}{l} + Hh_2 + \left(\frac{W}{2} - \frac{Hh}{m} \right) h_2 \tan a$$

Now, H equals $\frac{4}{10}$ W for all axle, according to the assumptions made in the report, and W equals 1.26 times the static load on both journals of one axle. $\tan a$ is the tangent of the angle representing the taper of the wheel tread and is 0.036. It is the same for all cases; h_2 is one-half the diameter of the wheel, or 16.5 for all 33-in. wheels; h is the distance from the top of the rail to center of gravity of car and is 72 in., practically the same for all cases; h_1 is the height of the center of gravity of the car above the center of the axle or 72 - 16.5 = 55.5 in., practically the same for all cases; M is the distance between centers of rails of the track or 59 in.; l is the distance between the points on the journals where the load is assumed to bear; b is the distance between the center of the rail and the point on the journal where the load is assumed to bear, or $\frac{1}{2}$ of $l - M$; x is simply the distance from the point where the load is assumed to bear on the journal to any point at which it is desired to find how much bending action or moment the axle is subjected to at that point.

In any given case M and l are known, hence b or $\frac{1}{2}(l-M)$ is known, therefore to simplify the equation b may be dropped, and $\frac{1}{2}(l-59)$ or $\frac{1}{2}l-29\frac{1}{2}$ be used instead. Substituting these factors in the long equation the result is:

$$M = W \left[x \left(\frac{22.2}{l} - .5 \right) + \frac{1}{2} l - 29 \right]$$

For all practical purposes this formula will apply just as it stands for any M. C. B. standard axle. Also, as l does not vary enough to make an important difference (less than 1½ per cent.) the formula may as well be further simplified by using an average value of l or 78 inches. The formula without losing any of its practical value for application to all M. C. B. axles now becomes:

$$M = 16W - .2Wx.$$

This very simple expression is the full practical equivalent of the complex one given above, as will be seen from the following results of its application to the new axle. The value of M or the bending moment at the center of the new axle is 320,000 inch-pounds, and the value at the inside of the wheel hub is 510,000 inch-pounds. These results agree with those in the committee's report. Applying this formula to the 4½-in. x 8-in. M. C. B. axle and taking the load for which it was originally designed, namely, 60,000 lbs., the results are:

For the center 222,000 inch-pounds, and for the inside of the wheel hub 353,000 inch-pounds.

The ratio of these bending moments is practically the same for both center and the inside of the wheel hub, or 1.44. This is what might be expected, as the lateral dimensions are so nearly the same for both. Also, and what is more important, the ratio of the cubes of the diameters of the axles, and, therefore, the calculated strength, are nearly the same as the ratios of the bending moments, which shows that the new axle is, by the formula used by the committee, made stronger than the 4½ in. x 8 in. nearly in proportion to the assumed load. The ratio of the cubes of the diameters at the center is 1.57 and at the wheel hub 1.38. Thus the new axle is a little stronger than the 4½ in. x 8 in. at the center and not quite as strong perhaps at the wheel hub in proportion to the load.

The point which this brings out is that the simple formula may be used in place of the complex one without practical error and with a gain in clearness that will be appreciated by those who have not time to read fully the Committee's mathematics.

A summation of the work of the Committee which directly affected the design of the axle between wheel hubs is somewhat as follows:

The mathematical part of Reuleaux's formula was corroborated for the Committee by Professor DuBois, of the Sheffield Scientific School, and the constant 1.26, for oscillation, was checked up by a test of a car

truck run over the Pennsylvania Railroad. This complex formula which may be reduced to $M = 16W - 0.2Wx$ was applied to some axles that had given good service, and the fiber stress was found to be 23,000 lbs. per square inch. Based on this, 22,000 lbs. was assumed to be safe, and the sizes of the axles were made to suit. Most of the other matter about stresses given in the report, although interesting, was not used in designing the axle and need not be read by those who only care to know just what was the real basis of the design. Some of the many difficulties which confront those who attempt to calculate a proper size of axle for a given static load and some of the problems connected with the manufacture of a larger axle than the standard for 60,000-lb. cars were set forth in the *Railroad Gazette*, April 26, May 3, 10, 17 and 24, 1895.

Wöhler's results are definite and easily understood. Perhaps they are as well set forth in Lanza's "Applied Mechanics" as anywhere in the English language. For small sizes of wrought iron Wöhler says an extreme fiber stress of 16,000 lbs. in opposite directions, that is reversing, will permit an unlimited number of reversals of stress without breaking. The corresponding figure for high-grade axle steel is 28,000 lbs. An important fact about this statement is that these figures are the *ultimate*, or highest stresses to which the piece can be subjected, and will only be withstood by material that is most excellent in quality and by specimens that are of small size, free from defects and practically homogeneous. These figures correspond with the ultimate strength given for iron and steel in tension. Thus we know that good boiler steel, if homogeneous, will stand 60,000 lbs. per square inch, and good boiler iron about 50,000 lbs., so we are told by Wöhler that good axle steel and good axle iron, if perfect, will stand in small specimens as a maximum the figures which he gives for repeated reversals of load. But to prevent any misunderstanding, and to show the need of allowing for practical conditions, which necessarily cause a variation in the material of actual structures, Wöhler adds the following important caution:

"We must guard against any danger of putting on the piece a load greater than it is calculated to resist, by assuming as its greatest stress the actually greatest load that can ever come upon the piece, and this being done the only thing to be provided for is the lack of homogeneity in the material."

From this it is apparent that Wöhler stopped in his recommendations where a conservative experimenter would naturally cease; namely, at a point where he could be definite, and left to the judgment of engineers the selection of such factors of safety as might seem best for each particular case.

All engineers and authorities on engineering subjects, following after Wöhler and taking his results as a basis, have, without exception used some factor of safety which would give, in their opinion, proper security against failures due to imperfections of manufacture, and unlooked-for stresses and weaknesses that might arise from the difference in the dimensions and shape between the small round specimens used by Wöhler and the larger and more complicated shapes common to engineering practice.

The smallest factor of safety for any important work, and surely an axle is an important piece, recommended by any authority for repeated stresses based on Wöhler's results, is 3. This would give for iron a reversing fiber stress of 5,333 lbs. and for steel of axle quality 9,333 lbs. per square inch. Such stresses seem reasonable for reversing and repeated loads when one remembers that for a steady load conservative engineers use a fiber stress of but 9,000 lbs. for good wrought iron and 12,000 lbs. for good steel. Surely the fiber stress with repeated and reversing loads should be less than with a steady load.

It is scarcely worth while to cite the long list of authorities which may be found in any technical library as to the factor of safety that it is best to use when Wöhler's ultimate stresses are taken as a basis. We doubt if anyone will dispute the opinion that an engineer called upon to fix a factor of safety for important work to be used under repeated and rapidly reversing loads, would use a factor of less than 3, and say when he had finished his design that he had made the dimensions according to his best judgment, based on pure analysis of the mechanism and the conditions, *per se*, to which the device was to be subjected. However, there are conditions under which an engineer finds that prior experience is a better guide than a purely scientific analysis, and undersuch conditions an engineer, guided by experience, might use a less factor of safety, believing it to be secure without knowing just why it is that the mechanism stands in service a heavier stress than pure analysis would show to be safe. Particularly is this true in cases where the stresses from the service conditions are difficult to calculate. One of these cases is a

railroad car axle and no analyst if conservative, however competent he might be, would deny that practical experience with car axles has given far more data for the proper selection of new sizes of axles than can be derived from any amount of calculation and analysis from a theoretical standpoint.

[TO BE CONTINUED.]

A Western paper reports that the Western Passenger Association has issued a circular on children's fares which says that:

"Investigations recently made show that conductors as well as ticket agents are not as careful in the enforcement of these requirements as they should be. Because of failure of ticket agents to collect proper charges at time of issuance of tickets an undue burden of responsibility is thrown upon conductors, some of whom have not exercised the necessary care, the result being that the rules in this regard have not been observed and the compensation due for service performed has not been received. Ticket agents should ask the question in each case whether the purchaser of a ticket is to be accompanied by a child or children, and, if so, if possible, ascertain the exact age of such children, requiring the purchase of tickets accordingly. They should also notify the ticket purchaser that conductors are required to insist upon the presentation of a half ticket for each child aged five years and under 12 years, and a full ticket for each child 12 years of age and over, and that if such half or whole ticket is not purchased in advance, increased expense, besides embarrassment and trouble to the passenger, will necessarily follow. Conductors must satisfy themselves in all reasonable ways as to the age of children, and must require purchase of tickets or collect train fare in all cases where the age of the child, as provided by the rules, requires."

The charm of this circular is in its innocence. The ticket agent who tries to make passengers believe that conductors will enforce the age limits soon finds not only that he is wasting his energies, but that the passengers themselves ridicule his statements. Probably the agents in the territory of the Western Passenger Association will ask, or feel like asking, what evidence can be given that the conductors have actually been reformed so that they will carry out their part of this order. We hope that the conductors really have been suitably disciplined, and should be glad to have the privilege of telling the world how it was done. Most conductors on way trains think they have trouble enough in getting fares out of all the adult passengers, and find it hard to work up courage enough to fight for the enforcement of the company's rights where much smaller amounts are involved. Tricky mothers, who think that cheating a railroad is doing a public service, are formidable antagonists, and a warning from the ticket agent doesn't scare them much. They know by experience that a ticket agent's prediction of "increased expense and embarrassment" on the train is not likely to mean much. When an agent, in accordance with this circular, "requires" a passenger to purchase a ticket, how is he going to enforce the requirement? If agents, "in each case" of the sale of a ticket, ask the buyer if he has a child hidden somewhere about the premises, we suspect that they will have the reporters of the Chicago comic papers after them. The only way for a ticket agent to help the conductor in dealing with people who are trying to get children carried for less than the rightful fare, is to do the same as would be done with any other fraud—point them out to him individually. Where the agent does not usually see the conductor, or has other duties at train time, this is not always easy.

The anthracite coal industry at once reflected the sound money victory. As we pointed out recently, the depressing trade feature was the extremely low price for the small sizes, which constitute about one-third of the production. On the day following the election there was a general inquiry for these coals, and subsequently there has been a hardening in values that has wiped out a portion of the decline. Domestic sizes are also reported to be selling well at a slight advance. There is now every indication that the September 1 circular, which is on a basis of \$4.35 net for stove coal, will be in the main obtained before the close of the year. Its continuance into next year of course largely depends upon the attitude of the producing interests toward the trade. Some effort is being made to induce producers to guarantee prices to retailers and large consumers. If this is done the trade will, it is said, accept without protest schedule based upon an average of \$4 for prepared sizes. One of the developments following the election was the promulgation of a circular by all of the interests affirming the Western lake prices. These were on a basis of \$5.75 for broken and \$6 for egg, stove and chestnut, at Chicago, Milwaukee and the head of the lakes. Some of the companies under a pressure from their trade put out circulars fully 50 cents below this schedule. Conferences were held just prior to Nov. 3, and a restoration agreed upon. Prices in that quarter are now said to be very firm.

NEW PUBLICATIONS.

Higher Mathematics. A Text-Book for Classical and Engineering Colleges. Edited by Prof. Mansfield Merriman and Prof. Robert S. Woodward. New York: John Wiley & Sons. London: Chapman & Hall, Limited. Octavo, pp. 576. Price, \$5.

This work was prepared by 11 authors, each of whom wrote one chapter, and no two chapters are upon the same subject, and it may be called a "meaty" work, devoid of "padding." The scope of the work may best be inferred from its table of contents, which is as follows: The Solution of Equations—Determinants—Projective Geometry

—Hyperbolic Functions—Harmonic Functions—Functions of a Complex Variable—Differential Equations—Grassman's Space Analysis—Vector Analysis and Quaternions—Probabilities and Theory of Errors—History of Modern Mathematics.

Notwithstanding this array of topics, two subjects of considerable note are wanting, viz.: "Elliptic Functions" and "N-dimensional Space." The former was not an oversight, as the editors inform us in the preface that its omission was due to circumstances, and we may say that the latter is not in keeping with the spirit of the work. However, Grassman's analysis, the elements of which constitute one chapter, is said to be the best system for the discussion of problems of hyper space.

Examples and exercise are freely interspersed with the theory in each chapter, so that the student has frequent opportunities of testing his knowledge and ability to apply the theory. In one chapter there are nearly 120 such exercises. Some of the problems may amuse a non-expert from their character. For instance, he may find something like the following: In an ice-cream freezer, cream of a homogeneous character and at a uniform temperature of 60 deg. Fahr. is put into a cylinder having a closed base, and the whole put into a freezing mixture so as to subject the base and convex surface to a constant temperature of 30 deg. Fahr. Required the temperature at any point within the cream after the expiration of a given time. Again, if the weight of integrity of each of 12 jurymen be known and a verdict be agreed to by 10 of them, what is the probability that the verdict is the truth? If one questions the utility of the study of higher mathematics when it can resolve such questions, we leave him to his own obduracy.

The construction of the book is novel. Not infrequently two authors join in the production of a book, but rarely eleven. In this case there is unquestionably an advantage, for each writer is restricted to a narrower field, and can thus do it better justice than if he wrote on several subjects. It is difficult to confine each to a sufficiently small space, and the editors notice that, with elliptic functions omitted, the book exceeds the size originally intended.

In regard to the solution of equations, we learn how the general equation of the fourth degree has been solved, and that the complete equation of the fifth degree is not algebraically solvable, although it may be solved by elliptic functions. The knowledge of these and other facts is brought up to the most recent date.

Determinants are treated in many works on algebra, probably sufficiently for the average student, but here we find quite a treatise crowded into 36 pages. We looked for the theory of transversals, in which we took considerable interest in former days, but find that it is scarcely more than a scholium to what is here a newly developed science, called "Projective Geometry," with its special notation, terms and language. It is complete in itself, and the student who masters the 36 pages and 40 problems will know more of the subject than we presume to.

To the student who has studied only the elements of trigonometry and of calculus, the chapter on hyperbolic functions will be a revelation. In a study but slightly advanced beyond the elements, one has occasionally hints that certain *imaginary* expressions may be written in the form of *real* ones, such, for instance, as $\cos x \sqrt{-1}$ and $\sqrt{-1} \sin x \sqrt{-1}$. The hyperbolic trigonometrical function is [written $\cosh x$, $\sinh x$, etc., and is read \cosh , \sinh , etc. A relation between ordinary trigonometrical functions and hyperbolic functions:

$$\cos x \sqrt{-1} = \cosh x.$$

$$\sqrt{-1} \sin x \sqrt{-1} = \sinh x.$$

And similarly for other functions. By the aid of the calculus it is quickly shown that real circular functions may be expressed in terms of imaginary logarithms, and the converse and these, in turn, may be expressed in hyperbolic functions. Quite an interesting feature of this chapter is the application to geometrical and physical problems with which the student is supposed to be somewhat familiar, such as: various Catenaries, Trajectory, Loxodrome, Combined Flexure and Tension, Alternating Currents, Miscellaneous Applications and references to numerous other problems. It closes with tables to facilitate computations. The length of this chapter—61 pages—is justified by the nature of the subject and its treatment.

To be told that a writer assumes an arbitrary form of a function for the answer to a differential equation will be a damper on the average student, and yet such is done on page 175. It is true it must be tested to see if the guess is correct. In the division of numbers and in the arithmetical extraction of roots, the computer always guesses and tests, but functions are of such an unnumbered variety of forms that one must have large intuitive knowledge and much experience to guess well. The equation here considered may be solved without such an arbitrary assumption, although it does not lead to such a definite form as that assumed by the author of the article, and requires ingenuity to complete it. Perhaps it is as well for the student to accept the statement of the author and learn *how* it is done, hoping that as his mathematical knowledge increases he will learn in what manner the forms were first suggested. The extract from an article by Professor John Perry is very fine and will be highly appreciated by the thoughtful student.

Functions of a Complex Variable are well treated and brought up to date in 76 pages; also Differential Equations in 72 pages; also Grassman's Space Analysis in 80 pages. Vector Analysis and Quaternions is presented in a way peculiar to that writer. The pages have more the appearance of ordinary algebra than the pages of some works where Scalars and Versors are more numerous. The problems are from various subjects. Probability and Theory of Errors appears to be presented in an elementary manner, and gives very clearly the real nature of the subject. The 40 pages and the 25 problems furnish a good foundation for a knowledge of this subject.

When we read the last chapter—"History of Modern Mathematics"—we musingly said that we wished we knew as much as Professor Smith, the author of that chapter; but he rather gives himself away for our benefit at the end, for he gives a bibliography of some 25 writers upon the subject and it is barely possible that he found in two or three of them more than enough to fill the space allowed him; but whatever the source of his information, he has made an excellent summary. From it we see how much we owe to European writers, not only for germ thoughts, but also for the development of the several subjects. There are some, but few, American names. The result is not strange when we consider the antecedents, the traditions and the environments in the two countries: but we hope that the mathematical scholarship in this country will in the future present a greater array of names among those in the highest ranks in this science, and that this work may mark a new era in it. The scholarship of the country is to be congratulated that a home publisher has assumed the financial responsibility and presented the work with such excellent typography.

TRADE CATALOGUES.

The Ranker & Fritsch Foundry and Machine Company, of St. Louis, has issued a catalogue showing its standard and heavy-duty Corliss, rolling mill, reversible, blowing and piston-valve engines ranging in size from 50 to 3,000 H. P. Much information is given in the form of tables and numerous cuts from drawings and photographs illustrate the peculiar details of construction.

Wolhaupler Tie-Plates.—The Railroad Supply Co., of Chicago, issues a very attractive advertisement in the form of a souvenir of the great sound-money parade of "Chicago Day," Oct. 9. The pamphlet contains a number of photographs taken as the parade was passing the offices of this company, also the legends on many of the banners which were carried. Interspersed are enticing advertisements of the Wolhaupler tie-plate. These latter consist of blue-prints and half-tones from photographs, a report by R. W. Hunt & Co., and sundry information with regard to the plate.

Car Heating by Steam.

(Concluded from page 789.)

Mr. MITCHELL (Erie): In answer to Mr. Morris' question, my idea of it is this, for local trains where the passengers are only going to be in the cars a few miles, the direct steam is the proper thing, but on through cars I believe in the hot-water system. You get a more uniform temperature with the hot-water system, you can control it better, and you do not burn the feet of your passengers. You have less than boiling water temperature in the one case, and in the other about 212 degrees plus steam pressure; hence, I believe that the hot-water circulating system gives better service for through trains.

Mr. MITCHELL: There is one thing very important in the water-circulating system of heating. Almost all of the sleeping cars and a great many of the coaches running to-day have the Baker heater system of water circulation, where the pipes are filled with water, and when you try to get circulation you often fail to get it on one side of the car, while you get it on the other, and this, in my judgment, is caused by a pocket of air accumulating in the cross-over pipes, which compresses as the pressure increases, but sufficient pressure is not obtained to move the water on the other side. This trouble was overcome several years ago by Mr. Geo. H. Johnson, general foreman in our Jersey City shop. I do not know whether Mr. Dixon claims this, as it is illustrated in his catalogue; but our man got it up. He decided he would work on a different scheme than formerly, and not fill the pipes with cold salt water directly from the barrel, so he opens the four blow-off cocks in the Baker system and attaches a steam hose to one of them. As soon as the steam would blow out of one valve he would close it, then the next and the next, after which the steam would blow out of the expansion drum; then by attaching a pipe to same, and passing its open end into a barrel of salt water, the steam would soon heat it up and expel all the air, after which the valve at steam connection is closed; and as the steam condenses it forms a vacuum in the pipes and lifts the water and fills the pipes with water free from air, which insures freedom from trouble, as mentioned previously.

Mr. DIXON: Mr. Dixon does not claim the honor of that discovery; but sometimes knows a good thing when he sees it. He has, however, a little improvement on heating the brine. Instead of allowing the steam to flow into the barrel of brine, thus diluting it, he carries steam through a coil within the barrel, having a valve at its lower end inside the barrel, and also one outside the barrel. The one inside the barrel being closed, and the one outside opened, the steam passes through the coil and out in the air, heating the brine on its way. When the brine is hot, the outside valve is closed and the inside opened, letting a good strong brine flow into the pipes.

Mr. SUMMERS (West Shore): . . . With regard to the hot-water system, we find trouble from the hot water not heating by reason of the pipes not being thoroughly cleaned out. I have found the very thing of which Mr. Mitchell spoke. Mr. Johnson must have

been up to the West Shore and seen the way we do things there. We blow the steam out through the stop-cocks, and then after all pipes have cooled off thoroughly (we do not do it without giving ample time to get cold) we do just the same as washing out a boiler. We apply cold water with a pressure of about 75 or 80, as we have that pressure at Weehawken, and go through the very same performance with the water that Mr. Mitchell describes with the steam, allowing the water to run until it is as clear as any spring water. I have washed out cars where I thought the dirt would never stop running. It ran as black as ink for 30 minutes. It would not seem possible that so much dirt could accumulate in the pipes.

Mr. McELROY: As to the cause of the Baker heater at times not circulating properly, to which reference has been made, I find that is due largely to the generation of pressure in the expansion drum, pressure on the whole circulating system, due to the fact that when the drum is filled full to its middle point with cold water and the water is heated and expanded, the air is compressed in the upper part of that drum, and in the great majority of cases it is due to pressure alone; and if you take a car with which you have that difficulty and at once proceed to the expansion drum and let that pressure off, a car that has stood for hours and not circulated will not stand for 20 minutes without taking a complete circulation. Another cause I have found—salt water is used in the Baker heater pipes. Salt water has a strong affinity for iron. Oxide of iron is formed and hydrogen gas is thrown off, and that is what causes the dirt in those pipes. The water would have stayed clean if it were not for the decomposition of the iron pipes that is taking place, and that dirt coming from those pipes is oxide of iron. Hydrogen gas has been formed and the pipes are partly filled with it, and the circulation is hindered. If you test that with a candle, as some men have done to their sorrow, an explosion is apt to take place, and in some cases I have known men to be knocked clear off the car from the explosion of hydrogen gas while inspecting the condition of the water in the system. We now use a valve placed at the end of the train pipe, discarding anything in the way of a cock. And, then, we now place the valve at the end of a car so it can be reached either from the end of the car or from the ground, and leave an opening so that water and a little steam, perhaps, will discharge constantly through the rear coupler. In that way the best results we have had yet in the train-pipe arrangements have been realized.

In regard to thermostatic traps, I will say very frankly that I am not a believer in thermostatic traps, especially as I am not a believer in them for live steam cars. The function of a thermostatic trap is simply to vary an opening; but the amount of the opening is a very uncertain one. The thermostatic trap is a device, so far as I have been able to determine by experiments, that at similar temperatures will not give the same discharge under the same conditions. It will for a time, but it gradually changes. As it changes it requires readjustment, and you have the uncertainty of the man who does the readjusting. A more reliable apparatus is made in the form of a valve having a predetermined opening, an opening made with the valve itself, and so arranged that that will give you about the average discharge you wish; and then, whenever you want to blow out your pipes, you simply raise the seat of the valve and let the steam and water discharge through it freely.

Some of the Consequences of the Election.

It is impossible to measure with any sort of accuracy the amount of the business revival which has followed upon the election. There is, however, sufficient actual evidence to show that the restoration of confidence in the integrity of the people of the United States has been followed by a return of business activity almost, perhaps entirely, without parallel. From all parts of the country comes the same story of a renewal of enterprise. The cities are filled with buyers from the interior points, the merchants have started out their salesmen, and mills and factories which had been shut down have again begun work, and those which had been running on short time have increased their forces and their hours of work, and prices of many staples have begun to rise. The situation as reflected in the financial center of the country can be best illustrated by a comparison of the volume of transactions in securities and of prices.

Stocks opened with a flurry on Wednesday morning. Prices made during the first few minutes of trading in many instances exceeded those which have since been recorded. The most tangible evidence of the improvement is in statistics, but it must be borne in mind that for a week before the election the stock market advanced. The average improvement in 20 active stocks from the close on Monday night before election to the close on Monday night this week, was 3.54 per cent. Burlington's gain was 7 per cent.; Chicago Gas, 5; General Electric, 5; Louisville & Nashville and St. Paul, 4 each; and Rock Island, 7. Some of the inactive high-priced shares appreciated as much as 10 per cent. The volume of transactions for six days ending Nov. 10 aggregated 2,745,795 shares of stock, against a normal of about 1,500,000 shares. In the bond market a greater change is recorded. Advances here fully equal the appreciation in stocks. The transactions over the period noted aggregate approximately \$20,000,000 par value, or an increase of over 100 per cent. of normal trading. High and low priced shares alike have participated in this demand and the buying has come from all quarters, including Europe.

The upward movement in stocks and bonds has been conservative, being attended at each level by traders' realizing sales. Toward the last of the period that has elapsed since the election, the industrial shares came into considerable prominence. This was due to reports of wholesale resumptions in manufacturing institutions and the quickening of trade in almost every line. When stocks of this class are leaders in the market, it is usual to find the railroads not far behind.

On Thursday, prior to the election, call money ran as high as 100 per cent. Time money, when it could be had, commanded 12 per cent. for short periods, and a loan

usually involved a gold option. The day before the election call money was 30 to 50 per cent. To-day the banks are heavy buyers of commercial paper at from 6 to 7 per cent., time money commands 5 per cent., and call loans are on a basis of about 4. Gold is pouring into the banks and Sub-Treasury and the New York bank statement on Saturday is certain to show a heavy increase in deposits.

We give below a summary of reports coming from all over the country, of the industries especially interesting to our readers. We do not pretend that these are strictly accurate. Most of them are gathered from the daily newspapers, and it is possible, indeed probable that a number of them have been somewhat colored by sanguine reporters. We hope to be able to present before long a more accurate and complete statement of the immediate effect on the railroads, but have not been able in the time that has elapsed to collect much information at first hand. The list below, in spite of any errors that it may contain, may be taken as showing with considerable accuracy the trend of affairs at this moment.

Railroads.

The Chicago, Rock Island & Pacific has put its shops in Iowa on nine hours a day, the first time in a year they have been run so many hours.

The shops of the Missouri Pacific, at Sedalia, Mo., which have been working about half the usual force for several months past, started up on Monday on full time with about 800 men.

The car shops of the Erie at Meadville, Pa., were put on full time on Monday. General Superintendent Moorhead, of the Ohio division, has issued an order increasing the hours of work on that division and increasing the shop forces.

The car shops of the Chesapeake & Ohio, at Huntington, W. Va., which have been on eight hours' time for a year, have begun running ten hours a day and are now employing 700 men.

The Lehigh Valley shops, at Easton, Pa., employing 600 men, have been put on nine hours' time. They have been running eight hours a day.

The Wabash shops at Decatur, Ill., which have been working only three days a week all summer, are now running six days a week with a full force.

The Cleveland, Lorain & Wheeling has ordered that its shops at Lorain, O., on which operations had been suspended, be completed at once.

The West Shore Railroad shops at Frankfort, N. Y., employing 800 men, started running on full time on Monday of this week.

The Erie Railroad has issued orders to its three principal locomotive repair shops to work an hour overtime during the present month.

The shops of the Baltimore & Ohio Southwestern, at Chillicothe, O., have been put on nine hours' time and the force increased.

The St. Louis, Iron Mountain & Southern shops at North Little Rock, Ark., which have been running five days a week on short force several months, have resumed full time with regular force.

Eight Traffic Manager W. P. Walker, Jr., of the Chesapeake & Ohio, said in an interview:

"If we have anything like the business we are now expecting we will not have ships enough and will have to build at least three of 10,000 tons burden. The Chesapeake & Ohio Steamship Line is having about all it can handle now."

President A. E. Stillwell, of the Kansas City, Pittsburgh & Gulf Railroad, announces that the company will at once put 1,500 men at work completing the line to the Gulf of Mexico, a work which has been delayed for a long time.

The St. Joseph & Grand Island has opened two of eleven stations closed over a year ago, and will soon reopen most of the others.

A Harrisburg dispatch states that the Pennsylvania, which has frequently had as many as 1,400 idle freight cars on its middle division, has put all these cars in service, except about 200, used in special traffic.

The shops of the New York Central & Hudson River, at West Albany, N. Y., which have been working on short time since August, 1893, are to be run on full time. It is understood that the Boston & Albany shops at East Albany also will go on full time in the near future.

The Pennsylvania has put its shops at Walls, Pa., which for a year have been running only eight hours a day, five days a week, on 10 hours' time, and the shops will be open seven days a week. The repair shops at Twenty-eighth street, Pittsburgh, will also run on full time.

The Lehigh Valley shops, at Hazleton, Pa., are now working nine hours a day six days a week instead of eight hours a day on five days as heretofore.

The Toledo & Ohio Central shops, at Toledo, have been put on nine hours' time, the shops heretofore having been run eight hours on five days a week.

Cars Shops, Etc.

The Ohio Falls Car Works, of Jeffersonville, Ind., is preparing to open its shops at once. It has an order for 2,000 cars, which was contingent upon Mr. McKinley's election.

The Barney & Smith Car Co., of Dayton, O., will immediately open its shops with a force of 2,000 men.

The Galveston Wharf Co. has decided to build a 600,000 bushel grain elevator at Galveston, and the plans are now being prepared. A director of the company in speaking of the decision said: "Had Bryan been elected we could not have raised the money for the work. Now we can get all we need, and the erection of the elevator will commence at once."

The lumber mills of the Ensign Car Manufacturing Co., on the Guyandotte River, which have been idle for several months, have started up, and the car works will be in operation next week.

The Mount Vernon Car Works, of Mount Vernon, Ill., have started on an order for 300 cars for the Louisville & Nashville, which was placed a few weeks ago.

The Niles Tool Works and other plants at Hamilton, O., have increased their forces.

The shops of the South Baltimore Car Works have been started on full time. The receivership has been terminated and the property transferred to the company's officers.

The National Switch & Signal Co., whose shops at Easton, Pa., have been running five days a week, will start up full

time. The company has had several orders contingent on the election of McKinley. Since the election orders have been received for a 16-lever machine for the Lehigh Valley, to be put in at Depew, N. Y., and the officers have been asked to prepare plans for a 28-lever machine, and a 12-lever machine, to be put in at points in Ontario, and a 16-lever machine for the Pittsburgh & Western road.

The large plant of the Pennsylvania Bolt & Nut Co., of Lebanon, Pa., has resumed operations in all departments, employing 500 men, after being idle for some time. The company expects to operate the plant all winter.

The Stanley Rule & Level Co., of New Brighton, Conn., whose shops have been run only four days a week for several months, also resumed on Monday.

The Russell & Irwin Manufacturing Co. started up its screw shop at New Brighton, Conn., on Wednesday with a full force.

The Sergeant Hardware Co., of New Haven, Conn., employing about 2,500 men, started up its factory on full time with a full force.

The Atlas Cement Co., of which J. Rogers Maxwell, President of the Central Railroad of New Jersey, is President, gave orders on Wednesday for additional buildings and machinery to be added to its plant at Northampton, Pa., involving a total expenditure of \$500,000.

McKee, Fuller & Co. will erect a large addition to their wheel foundry at Fullerton, Pa.

The Schoen Manufacturing Co., of Pittsburgh, has again resumed operations.

The Michigan works of the Michigan Peninsular Car Co. started work on Monday, and 400 men were set to work on repairs. The Peninsular shop has been running for some time with a reduced force.

The Westinghouse Electric Mfg. Co., which has been running but five days a week, started on a six-day schedule on Monday, giving one more day's work to 2,000 men.

The Pittsburgh Bridge Co. is increasing its forces in the various departments and expects several large orders.

Additional departments at the Pittsburgh Bridge Company's Works have been put in operation, owing to increased orders for structural iron and steel. The large works will be kept in operation continuously for an indefinite period.

Work has been resumed at the Dauphin Bridge Works, Harrisburg, which have been closed for some time.

The plant of the United States Car Co., at Hegewisch, Ill., which has long been idle, is to be started up at once, with 700 men.

Iron & Steel.

The blast furnace of the Clinton Iron & Steel Co., Pittsburgh, Pa., was blown in on Nov. 4. The furnace has been out of blast since July 1, and considerable improvements have been made, including new foundations, columns, jacket and three batteries of water-tube boilers.

The Buhl Steel Co., Sharon, Pa., has given the contract to the Shiffler Bridge Co., of Pittsburgh, for a brick and iron building, 100 x 900 ft., to contain the open-hearth furnaces, soaking pits and rolling mills.

The blowing-in of a furnace of the Niagara Iron & Steel Works, owned by the North Tonawanda Iron & Steel Co., was made the occasion for a public celebration which brought together nearly everybody in the town of North Tonawanda, N. Y. The furnace was connected by a special telegraph wire, with the house of Mr. McKinley at Canton, and on Wednesday afternoon, Nov. 4, the President-elect pressed the button of the telegraph wire and the fires of the furnace were started.

The Hainsworth Steel Co., of Pittsburgh, put its plant in operation Sunday night. All departments had been closed previously.

The Schoenberger Steel Co., of Pittsburgh, gave orders to complete immediately the new open-hearth furnaces now partly built.

The H. K. Porter Manufacturing Co. is preparing to resume work in three weeks. It had many orders contingent on the election of Mr. McKinley.

The Pittsburgh Forge & Iron Works put in operation 36 furnaces.

Jones & Laughlin have started up the new continuous mill at their great plant, and the steel mill has also been put into full operation.

The Quintard Iron Works, of New York, reports that it has already received a large number of orders.

The Birmingham rolling mills, employing 1,200 men, resumed work on Wednesday night, and the Alabama rolling mills, employing 700 men, on Monday. Other companies are arranging to start their idle furnaces if the activity continues.

The Paxton Rolling Mill Co., of Harrisburg, on Thursday began the erection of a flanging plant, which had been under consideration for some time, and as the result of the election was known, orders for the machinery were confirmed.

The Riverside Iron Works, the Bellaire Steel Works and a number of other mills at Wheeling, W. Va., were started up last week, all employing very large forces.

The two rolling mills at Terre Haute, Ind., are employing 400 more men than in the past six months.

The Gate City Rolling Mill has resumed operations with 800 men, and arrangements have been made to start the Bessemer Rolling Mill at Birmingham, which has been idle for a long time.

The Addyston Pipe Co. is making repairs to its mills at Addyston, O., and as soon as these are completed will start up two of the mills which have been idle for a long time.

The Shelby Steel Tube Works, at Shelby, O., which has employed only 300 men all summer, has hired 100 more since election.

The Chautauqua Ore & Iron Co. has resumed work in the mines at Lyon Mountain, N. Y., which have been closed a long time.

The Colorado Fuel & Iron Co. started its plant at Pueblo with 1,000 men on Monday.

The large steel plant of the Youngstown Steel Co., Youngstown, O., was put in operation on Friday.

Since the election the Ohio Steel Co. has received word to proceed with the filling of two orders for 4,000 tons of steel each.

The Pittsburgh forge and iron works, where nearly 700 men are employed, resumed in full Nov. 4. All the departments are now running steadily.

The Indiana Iron Co. of Muncie, Ind., which has worked about one-tenth capacity for a year, resumed with 800 hands on Monday. The Midland Steel Co. reports a great number of orders. The Muncie Iron Company has put its men at work on double turn.

The Lukens Iron & Steel Co. booked orders for 8,000 tons of manufactured steel plate last week after the election.

The mill of the Knoxville Iron Co. resumed work on Friday.

The Kittanning Iron & Steel Company's mill at Kittanning, Pa., which has been idle for months, will start up this week.

The Carnegie Steel Co. has decided to go forward at once with extensive improvements and additions to its plants, involving an expenditure of \$500,000. The order includes the completion of two blast furnaces, work upon which stopped about three months since.

The Edgar Thomson Steel Works has been undergoing repairs and additions and will start up during the week with about 3,000 men.

J. W. Gates, President of the Illinois Steel Company, made the following statement on Thursday of last week:

"In consequence of the victory of sound money we started up our Joliet works last night, which gives employment to 2,800 men, and I think that within a few weeks, probably early in December, we will start up the South Chicago works. We also have plans under consideration for extending our plant in Milwaukee, but nothing is definitely settled."

The North Carolina Steel & Iron Company's furnace at Greensboro, N. C., has been put in blast for the first time. Ore for its use comes from near-by mines.

The Glasgow Iron Co. has started its puddle and rolling mills at Pottstown, Pa., with a full force.

The Pottstown Iron Co. has started two rolling mills and a puddle mill, and is preparing to start other mills.

The steel mills of the Cambria Iron Co., at Johnstown, Pa., will resume work this week and give employment to large forces of men. It is expected to put the blooming and milling mills in operation also.

The puddling department of the Elmira Iron & Steel Rolling Mills, at Elmira, N. Y., which has been shut down for the past four weeks, started up on Monday.

The Tredegar Iron Works started up its spike mill at Richmond, Va., on Monday.

Orders to start the foundry department of the West Superior Iron & Steel Co. have been issued by the Receiver, Howard Morris, of Milwaukee.

The Oliver Iron & Steel Co. started its plant in full on Wednesday morning, employing 600.

The Clinton Furnace Co., located on the South Side, Pittsburgh, will start up in full this week, employing 300 men.

The puddling department of the Sligo Iron Works is under going repairs with the intention to start in full the latter part of this week.

The Hollidaysburg Iron & Nail Works, the Eleanor Iron Works, the Portage Iron Works and the Altoona Iron Co., the four leading iron plants of Blair County, Pa., have resumed operations on full time.

The Dayton Coal & Iron Co. has received orders for 10,000 tons of pig iron. The furnaces have been shut down, but several will resume operations at once.

The Riverside Iron Co., on Nov. 10, ordered its second furnace at Steubenville put to work at once. This puts the entire Riverside plant in full operation, and gives employment to over 3,000 men.

The No. 1 Colebrook furnace of the Lackawanna Iron & Steel Company is being repaired and operations will be resumed as soon as possible.

Hollow Forged Steel Shafts.

BY H. F. J. PORTER, M. E.

In order to fully appreciate the reasons why large shafts should be made of steel and "hollow forged," it will be necessary, first, to consider in detail the requirements which such shafts have to meet and then to determine upon the best material and apply it in the best manner to satisfy them. Shafts have various duties to perform. Sometimes they are subjected to torsional or twisting stresses only, as when a force is applied to a lever arm at one end and this force is resisted by the work which has to be performed at the other end. Occasionally shafts are subjected to bending stresses only, as when a heavy weight is carried in the center while bearings at the ends serve as supports. But most frequently we find shafts subjected to a combination of both twisting and bending stresses, as when an engine applies its power to a crank at one end to turn a shaft which supports at its approximate center a heavy electric generator or a heavy belted fly-wheel,

Authorities on machine design tell us that when considering shafts up to 10 in. in diameter, we may use 9,000 lbs. per square inch as the safe shearing resistance and tensile strength for wrought iron, and 12,000 for steel. When considering shafts above 10 in. in diameter, iron shafts must not be subjected to more than 8,000 lbs. per square inch and steel shafts to not more than 10,000 lbs. These figures are taken as one-half the elastic limit of the respective metals. Thus at the outset we find that we are required to use a larger shaft if we choose to select wrought iron as our material than if we decide upon cast iron.

The first hollow shafts were introduced to this country by Fried. Krupp, of Germany. They were made of crucible steel and after boring were oil tempered to restore the strength that was taken from them by boring. The most satisfactory method, however, of accomplishing the results sought for is that known as "hollow forging," which was introduced into this country from England by the Bethlehem Iron Company when they built their present forging plant. I will endeavor to explain what is meant by the term and give reasons for its adoption.

In the first place, as the walls of hollow shafts are comparatively thin, and yet must do the work originally intended to be performed by the solid forging, the metal must be absolutely without flaw or defect of any kind, homogeneous throughout, and thoroughly worked to give it strength. For this purpose, therefore, only fluid compressed open hearth steel is used and of a grade that will best insure satisfactory working. Its carbon may vary according to the purposes to which the forging will finally be applied, but its phosphorus and sulphur should not exceed .04 per cent.

In order that the metal should be sufficiently worked to give it strength and toughness, the best practice requires that the ingot should be at least twice the diameter of the finished forging. It is also made from 25 to 50 per cent. longer than otherwise would be necessary to take care of "piping" and "segregation."

The ingot is subjected to hydraulic pressure, which is continued until the metal is solid throughout, great care being taken to cool it slowly and evenly on all sides, as otherwise there is great danger of the surface metal

*Abstract of a paper read before the Western Society of Engineers, Oct. 7.

shrinking on the hot metal within to such an extent as to be cracked open.

The upper 25 or 50 per cent of extra length is then cut off and a hole nearly the size required in the finished forging is bored through the remaining piece. These two operations remove those portions of the ingot where impurities may have concentrated or where there may have been a tendency toward piping, and we now have a piece of steel that is as nearly perfect as can be produced. It is then ready for the forging process.

First, it must be reheated and as much care has to be taken in this operation as was taken in its cooling. For, as has been already shown, the metal in the interior of an ingot is already under stress, and heating it, if it were solid, is apt to increase that stress to such an extent as to expand the surface metal away from the center and leave cracks in the interior. The heat must, therefore, penetrate it slowly and uniformly from all sides. The shape of a hollow forging, however, is in its favor. The hole in the center allows the heat to penetrate the thin walls from within as well as from without and thus the danger of cracking is to a great extent removed. After being reheated, a steel mandrel of the proper size to fit loosely is inserted into the hole, and the piece is placed under a hydraulic press where the metal is drawn out over the mandrel to the required dimensions.

One of the first requisites in forging is the proper selection of forging tools, suitable in design and power for the work in hand. The pressure applied in shaping a body of steel should be sufficient in amount and of such character as to penetrate to the center and cause flowing throughout the mass. As this flowing of the metal requires a certain amount of time, the necessary pressure should be maintained throughout a corresponding period.

Another reason why a higher factor of safety is placed on solid forgings more than 10 in. in diameter is that the forges do not possess hammers heavy enough to affect their center; or if by top steam or long drop they are able to be felt through the whole forging, the effect is produced by velocity of impact rather than by weight of falling mass. This results in damaging the surface metal, tending to draw it out, leaving the central portion behind, thus producing at times actual cavities.

Besides the undesirability of using the hammer on steel for the above reasons, it is a very difficult matter to make a forging of this character, except by the use of the hydraulic press. A slow and even pressure is absolutely necessary to draw out the thin cylindrical walls equally, and make a shaft that is straight and symmetrical throughout. The varying impact of the hammer works the metal so unevenly that the mandrel would be apt to stick fast to the forging. For this type of the steel forging, therefore, it is practically imperative that the press be used, and thus the metal is unavoidably subjected to the best method of treatment.

With hollow forgings manufactured under the processes here described, the possibility of having a defective center is eliminated by taking out the center altogether. By substituting for it, during the process of forging, a mandrel, the latter acts as an internal anvil, and thus even in the largest hollow shafts the thickness of metal worked upon would be within the limits above mentioned. The use of hydraulic presses having a capacity of from 2,000 tons to 14,000 tons, selected according to the size of the forging under treatment, can leave no doubt in the most incredulous minds that the metal has been thoroughly worked.

After the process of shaping to the proposed design has been accomplished, the piece must be subjected to a final treatment of "annealing." After all the manipulation to which it has been subjected, together with its frequent partial heatings and irregular coolings, it undoubtedly has strains set up in it. It is to relieve these strains that it must be annealed. This treatment consists in heating the forging slowly in a furnace and then allowing the latter to cool down slowly with the forging in it. All forgings, whether hollow or not, should be annealed, otherwise there is a certainty of the forging strains developing into weakness after they have been in service, causing them to get out of true, with a possibility of their breaking, particularly if subjected to alternating strains as in heavily weighted shafts or connecting rods, and especially piston rods, which are subjected to changing temperature. Annealing not only relieves these strains, but gives a finer grain to the metal and increases toughness.

On the treatment of steel after forging depend to a great extent its physical qualities, and it will vary in strength accordingly from that of the best wrought iron to between three and four times its strength. I refer not so particularly to the "elastic limit" as to its toughness and ductility, as shown by the "elongation" and "contraction of area." Annealing generally lowers the elastic limit slightly in well made forgings, annealed forgings showing it to be about 47 per cent. of the ultimate strength. It considerably increases, however, the "elongation" and "contraction." To develop these qualities to their fullest extent in any grade of steel, "tempering" is resorted to. This consists in heating the forging to a temperature which experience has shown to be right according to the purpose to which the forging is to be put and then plunging it into a bath of oil or other suitable liquid. It is then carefully annealed. This double treatment (which is properly covered by the one word "tempering") tends to harden it, breaks up the crystalline structure due to forging, and modifies the physical properties by increasing the elastic limit and adding toughness.

Forgings must be hollow to be tempered successfully otherwise strains would be introduced by the sudden shrinkage of the surface metal on the hotter interior when the piece is dropped into the cold bath, which instead of strengthening the piece results in weakening it, and possibly in bursting it into pieces. The thin walls of hollow forgings allow the heat to be extracted rapidly from both the inner and outer surfaces and thus much danger of accident during this process is removed. Thus the shape of the hollow forgings allows the highest physical qualities of the steel to be developed.

With the substitution in the trade of steel for wrought iron in engine and miscellaneous forgings, the tendency has naturally been to use a mild or soft steel approaching iron as regards physical qualities and in the ease with which it can be machined. Wrought iron has a low elastic limit, averaging about 20,000 lbs. per square inch in large sections, where proper care is taken in its production.

Although mild steel, when of good quality, is superior to wrought iron in strength, toughness, homogeneity and freedom from danger of imperfect welds and porous spots inclosing slag and scale, still it does not possess the very desirable quality of high elastic strength combined with ductility or toughness in as great a degree as can be obtained without danger in harder steel, when proper precautions are taken in its manufacture. In other words, in the use of ordinary mild steel, only a partial advantage is taken of the most desirable qualities of steel which are easily within reach. In some instances

where the amount of machine work in finishing is very great, and there is ample margin of safety in the design, as, for instance, is often the case with connecting rods, the use of mild steel may be advisable. Such steel contains about .20 to .25 of one per cent. carbon and can be guaranteed to show in specimens four diameters in length cut from a full-sized prolongation of forgings or from representative pieces, a tensile strength of not less than 57,000 lbs. per square inch and an elastic limit of not less than 27,000 lbs. per square inch, with an average elongation of 25 per cent.

For the general run of engine forgings, however, a harder steel should be used in which a tensile strength of about 75,000 lbs. and an elastic limit of 35,000 lbs. per square inch can be obtained with an average elongation of 20 per cent. in four diameters. When proper precautions are employed, forgings can be made with perfect safety of a still higher grade of steel, and this is especially recommended for crank and cross-head pins and for all parts subjected to severe alternating strains and wearing action. In this grade of steel a tensile strength of about 85,000 lbs. and an elastic limit of about 40,000 lbs. per square inch can be obtained with an elongation of 15 per cent. in four diameters. If steel forgings are tempered they will possess still higher qualities than those above mentioned and can be furnished with a tensile strength of 85,000 to 90,000 lbs., and an elastic limit of 45,000 to 55,000 lbs. per square inch, and an elongation of 20 to 15 per cent. in four diameters. By introducing about 3 per cent. of nickel into the composition of steel, a finely granular or amorphous condition is obtained in forgings, and the very highest quality of steel is attained. By the combination of hollow forging and tempering this nickel steel, a material is obtained excelling all others known in elastic strength and toughness.

Assuming that steel less than 10 in. in thickness may be submitted to a fiber strain of 12,000 lbs. per square inch, and when 10 in. thick and thicker it must not be submitted to a greater strain than 10,000 lbs. per square inch, we may so reduce the thickness of metal operated upon in shafts of larger diameter than 10 in., by hollow forging them, that the walls will be less than 10 in. in thickness. The shaft for the Ferris wheel, for instance, the largest ever made, is 45 ft. long, 32 in. outside diameter, with a 16-in. hole through it. By allowing 10,000 lbs. fiber strain in metal less than 10 in. thick, we find that hollow forged shafts are shown to be as strong, or stronger, than solid shafts of the same outside diameter. Taking for example the Ferris wheel shaft above mentioned, we find that, when compared with a solid shaft of the same outside diameter, it has lost 25 per cent. in weight and gained 12 per cent. in strength.

Foreign Railroad Notes.

The Prussian Minister of Public Works orders that hereafter all written orders, reports, etc., be made as brief as is consistent with clearness, and that within a given management ("direction") uniform abbreviations be employed, prescribed by the management itself. Those accustomed only to American methods have little idea of the vast mass of writing customary in continental offices, which seems to be a heritage from official routine in other government departments.

The French authorities have recently compiled new regulations concerning the transportation of explosives and ill-smelling freights. This is meant to be complete, and as it consists of 168 sections and enumerates 266 different kinds of goods, it may reasonably be supposed to cover the whole ground—for the present—as rules for half a dozen articles or so seemed to do in the early days of railroading. The French authorities, however, recognize that in the progress of modern industries new articles are likely to be introduced nearly every year, which must be classed with the 266 already known, and they have facilitated dealing with them by distributing the different wares into six different classes, according to the precautions required in carrying them. Thus, when a new explosive or stinking freight is brought on the market, instead of making a special set of rules for it, it can be assigned to a class for which rules are already made, and with which the carriers are already familiar.

Nitro-glycerine is entirely excluded from transportation by the French rules. The chief precautions as to ill-smelling freights regard the places where they may be loaded and unloaded, and the requirement that it be done quickly, within three hours at most. The list covers some poisonous wares and many which, though not explosive, are easily inflammable, such as oily waste and rags, matches, etc.

TECHNICAL.

Manufacturing and Business.

The Railway Material & Tool Exhibit Co., of which Mr. Smith H. Bracey is President, has opened a large exhibit room at 504 Great Northern Building, for the purpose of exhibiting all kinds of railroad appliances. As the Great Northern Building is connected with the hotel, this exhibit room will be easy of access to railroad men and others visiting the city.

The affairs of the New York Frog & Switch Co., of Bayonne, were finally settled in Chancery at Jersey City last week. Receiver Frederick B. Day reported that he had \$10,000 in hand, out of which he is to pay the creditors 50 per cent. of their claims.

The Keystone Axle Co., of Baltimore, Md., with works at Beaver Falls, Pa., on Jan. 1, 1897, will make car axles by a new process. Car axles will be made by rolling, instead of by the usual method of forging. The company's building has been put up by the Pennsylvania Bridge Co., it is 80 x 200 ft. in size, the framework is iron, and the roof and sides are covered with corrugated iron. Six Brownell boilers, of 1,200 H. P. capacity, are being installed. The special axle machines were invented by John T. Rowley, Tyrone, Pa., and are being made by Robinson, Rae & Co., Pittsburgh. The capacity of the plant when in operation is estimated at 250 axles per day. A continuous heating furnace, to burn oil instead of coal, has recently been installed at the works.

The Chattanooga Coupler & Supply Co. has been incorporated in Chattanooga, Tenn., by George H. Peirce M. T. Freeman, C. S. Wilkins, William Long, B. D. Haskins and others.

The Atlas Bolt & Screw Co., successor to the Ball-Bearing Car Wheel & Mfg. Co., Cleveland, O., is moving into its new plant, where it will make brick cars, dryer cars and other small railroad cars, besides wire nails, bolts and screws.

The Franklin Steel Casting Co., Franklin, Pa., has been making large additions to its plant. Additional buildings have been put up, and furnaces, cranes and tools added to the equipment. The plant has now a capacity to turn out castings up to 60,000 lbs. in weight.

Mr. R. H. Hood has removed his office from the Huylar Building, Twelfth and F streets northwest, to the Bank of Washington Building, Louisiana avenue, Seventh and C streets, N. W., Washington, D. C.

Mr. H. B. Hodges, Superintendent of Tests of the Southern Railway Company, has issued, under date Oct. 3, 1896, a certificate of the results of a tensile test of Falls' hollow stay-bolt iron as follows: "Area in square inches, .657; elastic limit per square inch, 31,600 lbs.; ultimate strength per square inch, 51,000 lbs.; elongation, 31½ per cent.; fracture fibrous; iron meets requirements." During the many years that the Falls Company have been supplying hollow bolts they have been repeatedly, and always successfully, subjected to similar tests, confirming the practical results of safety and economy in their extended use.

New Stations and Shops.

The contract has been awarded by the receivers of the Baltimore & Ohio for the further extension of the freight yards at Cumberland, Md. Lane Bros. & Co., of Virginia, will do the work, which will cost about \$25,000. It includes the construction of two new yards to be known as C and E, and the completion of yards A and D.

The plans for the long-talked-of station for the Pittsburgh & Lake Erie, at Pittsburgh, have been prepared and will be submitted to the Board of Directors at their next meeting. It is expected that the plans will then be approved and that work will be commenced early next spring.

The Southern Railway has about completed a large and commodious freight house at Greensboro, N. C. The construction of a passenger station will probably be commenced soon. Both structures will be brick.

The Baltimore & Ohio will probably reconstruct its Camden Station in Baltimore, so that passenger trains will not have to back in and out as at present. It is contemplated to erect new passenger sheds and necessary buildings near the mouth of the tunnel, by which the movement of trains between Washington and New York will be facilitated.

The Shiffler Bridge Co., of Pittsburgh, has the contract for the iron work of the roof of the new roundhouse on the Cornwall & Lebanon, at Lebanon, Pa. The building is to be under roof by Dec. 25.

Iron and Steel.

The Alabama Iron & Steel Co. has been placed in the hands of a Receiver, A. J. Perry, of Birmingham, having been appointed to that office. The property consists of a charcoal iron furnace and nail mill at Brierfield and a large tract of ore land in that neighborhood, together with a considerable quantity of manufactured iron now on hand. The receivership was made necessary by the recent death of Major T. J. Peter, former manager and part owner of the property.

The three furnaces of the Mahoning Valley now in blast are: Grace furnace, of the Brier Hill Iron & Coal Co., Youngstown, O.; Struthers furnace, of W. C. Runyon, Cleveland, O., and Hazelton furnace, of the Andrews Bros. Co., Hazelton, O. It is expected that Hannah furnace, of the Mahoning Valley Iron Co., Youngstown, O., will be blown in very shortly.

The furnace of the North Carolina Steel & Iron Co., at Greensboro, N. C., was blown in for the first time on Nov. 5. The company was reorganized some months ago, and is now known as the Greensboro Furnace Co.

A contract for the iron work for five buildings, to be erected by the Mariopol-Nicopol Mining & Metallurgical Co., of Mariopol, Russia, has been given to the Shiffler Bridge Co., Pittsburgh, Pa.

The ram for the U. S. battleship Kearsarge, now being built at Newport News, was cast recently by the Penn Steel Casting Co., Chester, Pa. The casting weighs about 70,000 lbs, two 25-ton furnaces being used in making it.

Determining Carbon in Steel.

Mr. Peipers, an engineer at Remscheid, has introduced a method of determining carbon in steel which is similar in principle to the assay by touch in use for gold. A series of test-bars of known carbon contents, and varying from each other by about 0.2 per cent. between the limits 0.2 per cent. and 1.2 per cent., and a slab of hard biscuit porcelain are used. The bar is hammered and filed to a blunt conical point, which leaves a black mark when rubbed on the porcelain slab. The sample to be examined is rubbed upon the center of the plate to form a patch of about the breadth and length of the finger, a similar one being made on either side of it with two of the bars whose composition is known, the patches all being uniform in depth of tint. The marked slab is then immersed to about half its depth in a beaker containing a 12½ per cent. solution of copper-ammonium

chloride in water, which dissolves away the iron from the immersed portions of the patches, leaving the carbon behind as a gray stain, whose intensity increases with the percentage proportion. Steel with about 1½ per cent. of carbon is nearly as dark after as before immersion, while that with 0.25 per cent. gives only a very pale shade when the iron is removed. If the metal were perfectly free from carbon, the mark would be completely dissolved.—*American Manufacturer.*

Pig Iron Production of Great Britain.

The statistics given by the British Iron Trade Association, of the production of pig iron in the United Kingdom during the first half of the present year, show that more pig iron has been made in that time than in any other six months in the history of the country. The total production was 4,328,444 tons, against 3,721,870 tons in the first half of 1895, and 3,708,270 tons in 1894. The greatest yearly output of pig iron on record was in 1882, when 8,493,287 tons were produced, according to the figures of the British Iron Trade Association, and 8,586,680 tons, according to the returns of the Home Office. In 1895 the total output was 7,703,459 tons. The present increase is distributed fairly well over the principal producing districts, being most marked in the Cleveland district and in Scotland. Of the total 4,328,444 tons for the six months, 2,054,552 tons were forge and foundry iron, 2,127,184 tons were hematite and basic iron, and 146,708 tons spiegeleisen, ferro-manganese, chrome and silicate iron.

A Decision on Electric Railroad Motors.

The patent infringement suit brought by the Adams Electric Railway Company against the Lindell Railway Company, both of St. Louis, by which the Adams Electric Company attempted to establish its exclusive right to the use of electric motors on railroad cars by the usual method of attachment, has been decided adversely to the Adams Company. The Sprague motor was the particular one attached and the General Electric Company was the real defendant. The United States Circuit Court, St. Paul, Minn., confirmed the decision of the lower Court, holding that the Sprague electric motor was not an infringement on the patent of Wellington Adams, as the absence from a device, that is alleged to infringe a patented construction, of a single essential element of that combination is fatal to the claim of infringement. An armature of an electric motor so mounted upon the driven axle of the car as to revolve around it and a field supporting frame rigidly secured to, or formed in one with the axle boxes of the driving wheel, are two essential elements of the combination claimed by Adams' patent. The combination used in connection with the Sprague motor does not contain either of these two essential features.

Dr. Wellington Adams, it will be remembered, was one of the principal promoters in the scheme to build an electric road between Chicago and St. Louis, on which an average speed of 100 miles an hour was to be attained. This project was discussed at some length and shown in its true light in the *Railroad Gazette* March 10, 1893.

A New Steam Garbage Scow.

An automatic steam dumping garbage scow, for the use of the Street Cleaning Department of New York City, was launched from Louis Nixon's ship-yards, Elizabeth, N. J., on Nov. 9. The scow, which was named the Cinderella, was built from the designs of Lieut. Daniel Delehanty, U. S. N. It is a twin-screw, double-hulled, catamaran-shaped vessel, formed of two pontoons, each 135 ft. long. Between these pontoons is hung the garbage-carrying compartment. This is wider at the bottom than at the top, so there can be no clogging during dumping. When the craft is light the garbage compartment will ride clear of the water, thus reducing the displacement to a very small comparative figure.

Torpedo-Boat No. 4 Launched.

Torpedo-boat No. 4 was launched at the Columbian Iron Works, Baltimore, Md., on Nov. 10. No. 4 is the second of its class launched by the Columbian Company, No. 3, which was launched on Oct. 1, being the first. A third is still under construction at the company's works. These three boats are all under contract to make a speed of at least 24½ knots an hour. They will have no names, but will be known by their numbers only.

An Accident to U. S. Battleship Texas.

On Nov. 9, while lying beside the Cob dock in the Brooklyn Navy Yard, the battle-ship Texas was sunk by the breaking of the yoke of the injection valve. This yoke is used to hold the bonnet or top of the main injection valve, which is placed in the engine-room and used for bringing sea water into the vessel from a flange which opens on the sea from the bottom of the ship. When this yoke broke, the pressure of the water coming up through the pipe was too great for the bonnet to stand, and it gave way, the water coming in and flooding the three engine-room compartments, and such others as could not be reached in time to close. The vessel was in about 20 ft. of water at the time, at low tide, and settled down until it was stuck in the mud, a few feet below the water line. Wrecking tugs were sent for, and the water pumped out from the engine-rooms. The accident occurred at 6 a.m., and the Texas was floated on the following night. A board of inquiry has been appointed by Secretary Herbert to investigate the accident.

THE SCRAP HEAP.

Notes.

The car steamer St. Charles, which for the past year or two has been in the service of the East Louisiana Railroad, at New Orleans, was destroyed by fire Nov. 3.

The Southern Pacific has just distributed among the section masters of the Pacific System seven gold and silver medals for excellent records made at the annual track inspection.

The Queen & Crescent route now runs a passenger train through from Cincinnati to New Orleans in 24 hours. The train leaves Cincinnati at 8:30 a.m. The distance is 830 miles, making the rate of speed, including stops, about 35 miles an hour.

The New Jersey State Board of Assessors has completed the assessment of railroad and canal property in that state for the year 1896. The aggregate valuation is \$231,757,969, and the taxes amount to \$1,521,496, a slight increase over the preceding year.

The United States Pipe Line Co. has finally secured the dissolution of the last injunction against its use of the right of way beneath the railroad tracks, and on Nov. 7 began pumping oil from Bradford, Pa., to Hampton, N. J. The pipe has been laid about two years, but the railroad companies have persistently fought the right of the pipe line company to cross the railroad right of way.

President Cleveland has pardoned three California strikers who were sentenced to 18 months' imprisonment for participation in the strike riots of 1894. The President says that these men were not criminals, but were led astray by "yielding to the counsels of disorder," and that the purpose of the imprisonment, especially as regards its effect as a warning to other guilty persons, has probably been accomplished.

The Railroad Extension to Peking.

From a private letter from China, written in August, we learn that the extension of the Imperial Railways toward Peking is suspended because of floods. Much of the line is under water, the Hun Ho having burst its banks and flooded the country. Nothing can be done until the water goes down. The last time that this happened it took over two years to restore the banks and get the country dried up. The time of completion of the extension to Peking is therefore pretty indefinite.

Railroads in China.

Li Hung Chang, being asked while on his way from Vancouver to Yokohama, if the railroad and other enterprises which it is proposed to begin in China would be made through foreign concessions or with foreign capital, replied, promptly, "No, by Chinese capital entirely." This is reported in the *Path Finder* for November in a letter from Mr. Gardner, President of the New England Railway Publishing Co.

A Cuban Railroad.

The annual report of the Western Railroad of Havana (Cuba), just published in London, shows that the damage to the company's property caused by the insurrection up to June 30 amounted to \$195,000. A claim for this amount has been presented to the Government. The general stagnation of business is, of course, more harmful to the interests of the road than the physical damage to its property. Beyond Rincon, 14 miles from Havana, trains are run only occasionally and under the protection of military escorts.

Coal by Water to Mobile.

The Tuscaloosa Coal & Transportation Company has been organized with a nominal capital of \$50,000. The company proposes to take coal to Mobile from Tuscaloosa for domestic and export use. The projectors state that they will be able to put down coal in Mobile at a cost of \$1.25 a ton, and while the cheapest coal supplied to steamers is from \$2.20 to \$2.30, they propose to put it down to \$1.75 per ton, and in this they state they will make Mobile the cheapest coal port in the United States. Tuscaloosa is 413 miles from Mobile. The mines from which the coal will be taken are the Searcy mines, new ones, the first coal mined being brought to Mobile in barges several months ago.

Reclaiming Florida Lands.

Extensive surveys and plans have been made by a civil engineer from England, at great cost, for draining the upper valley of the St. John's River, Fla. The area to be reclaimed by the proposed operations is about 60 miles long, by 10 miles wide, and is elevated from 13 to 21 ft. above the ocean. It is separated from the Indian River (which is a tidewater lagoon) by a narrow strip of low land, from 5 to 9 miles in width, and drainage into this lagoon is natural and easy in several places. Some of the richest land in the state would be made available for cultivation by this reclamation. Judge B. F. Harrison, of Pensacola, is one of the promoters. A reconnaissance and levels of this land were taken by J. F. Le Baron, a civil engineer of Jacksonville, in 1881, which first demonstrated the practicability of draining the territory.

An Accident to the Fuerst Bismarck.

The Hamburg-American Line steamer Fuerst Bismarck met with an accident during her last western trip. On Nov. 5, when the vessel was 465 miles from Sandy Hook, Chief Engineer Johnas discovered that the crank shaft of the low-pressure cylinder had cracked through immediately under the bearings abaft the crank. No further damage was done to the machinery of the vessel, which proceeded under the port engines and propeller, arriving in Hoboken about 10 hours behind time. The accident to the crank shaft was believed to have been due to defective casting. A curious coincidence of the breakdown is that the Fuerst Bismarck was the vessel to bring back on her last trip the news that the American Line steamer Paris, eastward bound, had broken her starboard shaft 320 miles off Sandy Hook. The Fuerst Bismarck had a spare shaft on board, which was put in place of the cracked one, so that the steamer sailed again on schedule time, Nov. 12.

New War Vessels Named.

The names of the several war vessels now being built for the United States have been announced by Secretary Herbert, as follows: Battleship No. 7, being built at the Newport News yard, Va., the Illinois; No. 8, at the Cramp's yard, Philadelphia, the Alabama; No. 9, at the Union Iron Works, San Francisco, the Wisconsin; No. 10, at the Crescent shipyard, Elizabeth, N. J., the Annapolis; No. 11, at the Bath shipyard, Maine, the Vicksburg; No. 12, at Bath, Maine, the Newport; No. 13, at Dialogue's shipyard, Camden, N. J., the Princeton; No. 14, at the Union Iron Works, San Francisco, the Marietta, and No. 15, also at the Union Iron Works, the Wheeling.

New York State Canal Contracts.

The following contracts for improving the Erie and Champlain canals under the \$9,000,000 canal improvement appropriation were awarded on Nov. 5 by Superintendent of Public Works Geo. W. Aldridge. For improving the Erie Canal from lock No. 20 to lock No. 21, to J. W. Whalen, Whitehall, N. Y., for \$52,910; from lock No. 27 to lock No. 28, to Lauer & Hagaman, Rochester, N. Y., for \$74,159; from lock No. 28 to lock No. 29, to Gallo & McNamee, New York City, for \$31,590; from lock No. 32 to lock No. 33, to Brumelkamp & Lee Co., Syracuse, N. Y., for \$88,434; from lock No. 33 to lock No. 34, to Lauer & Hagaman, Rochester, N. Y., for \$43,831; from lock No. 42 to lock No. 44, to John V. Quackenbush, of Mohawk, N. Y., for \$113,436. For improving the Champlain Canal from a point 200 ft. south of the Waterford cut to lock No. 5, to Whalen & Higgins, of Waverly, N. Y., for \$58,376; from lock No. 6 to lock No. 7, to J. W. Whalen, of Whitehall, N. Y., for \$92,296; from lock No. 15 to lock No. 16, to Mahan & Sundstrom, of Sandy Hill, for \$214,317. For improving the Erie Canal from lock No. 22 to bridge No. 55, to Shear & Haight, of Schenectady, N. Y., for \$79,320; from lock No. 44 to lock No. 55, to John B. Quackenbush, of Mohawk, N. Y., for \$38,749.

Lake Notes.

The Rockefeller steamer Bessemer and consort, towed by the steamer, carried out of Lake Superior recently a combined cargo of 10,037 net tons of iron ore, on about 15.5 ft. draft. This was pulled at about 11 miles an hour by one 1,200-H. P. triple engine, consuming about one ton per hour of coal. The steamer probably had a total crew of about 30 men, the barge less than 10. This shows the possibilities of cheap traffic on the lakes. The vessels took advantage of the new 16-ft. channels out of Lake Superior.

For the season up to September 30, the total amount of freight passing the Sault Ste. Marie Canal was 12,793,441 net tons, as against 10,990,826 tons last year, 9,097,452 tons in 1894, and 8,097,471 tons in 1893. East-bound freight furnished 10,117,340 tons, and west-bound 2,676,101 of the total amount this year. The east-bound freight included 6,811,765 tons of iron ore, and 93,271 tons of copper, and the west-bound freight included 2,045,740 tons of bituminous, and 297,582 tons of anthracite coal.

LOCOMOTIVE BUILDING.

The Wabash is reported in the market for 30 new locomotives.

The Seaboard Air Line is reported to have given an order for 12 locomotives to the Richmond Locomotive & Machine Co.

The Baldwin Locomotive Works, Philadelphia, have delivered four new locomotives to the Canada Atlantic. Two are moguls and the other two are passenger locomotives.

The Cooke Locomotive & Machine Co., of Paterson, N. J., has just completed a new passenger engine for the Grand Trunk, to run on the Chicago Division, from designs by F. W. Morse, Superintendent of Motive Power. It is for fast passenger service and weighs 120,437 lbs.

Eight freight locomotives belonging to the C. C. C. & St. L. Ry. have been converted from simple to compound engines, by the Richmond Locomotive & Machine Works. This company has a contract to convert 60 freight locomotives of the Big Four as fast as they are taken off the road for general repairs.

CAR BUILDING.

It is reported that the Norfolk & Western will increase its equipment.

The Mt. Vernon Car Manufacturing Co. has started up its shops on the Louisville & Nashville order for 300 coal cars.

The Ensign Manufacturing Co., of Huntington, W. Va., received an order from the Chesapeake & Ohio for 200 coal cars of 30 tons capacity, conditional upon the election of McKinley.

BRIDGE BUILDING.

Ashland, Pa.—The new county bridge at Lost Creek, which was almost completed, has been washed away.

Carpenterville, N. J.—The Freeholders of Warren County have decided to build a new iron bridge over the Pohatcong Creek, near Carpenterville. The new site is on the eastern side of the Belvidere & Delaware's bridge.

Charlotte, N. C.—The Board of Commissioners of Mecklenburg County has ordered a new bridge built over Rocky Sugar Creek, ten miles from here. The matter has been referred to W. R. Brown, of this place, who will superintend the letting of the contract, and determine upon the character of the bridge to be built.

Green Bay, Wis.—The council has passed an ordinance providing for an issue of \$27,000 bonds. Of this amount \$12,000 will be used to build a new bridge, for which plans have been prepared, over Fox River at Main street. E. L. Shaw, City Engineer, Marinette, Wis.

Hamilton, Ont.—The contract for building a bridge over the Trent Valley Canal at Auburn has been awarded to the Hamilton Bridge Co., of this city.

Hartford, Conn.—At the election the city gave a vote of 5,381 to 1,763 in favor of a \$25,000 appropriation for a masonry bridge over Park River at Park street, the bridge to be about 70 ft. roadway and 54-ft. span.

Houston, Tex.—It is stated that the City Engineer has been authorized to prepare plans for a bridge over White Oak, near Beauchamp Springs, to cost about \$6,000.

Lebanon, N. H.—Reports state that a petition has been presented to the Supreme Court for the issuance of a mandamus to compel the town of Lebanon to build a bridge across the Connecticut River from a point in Lebanon to Olcott, Vt., and to apportion the sum which the town of Hanover should be assessed.

Moundsville, W. Va.—The Baltimore & Ohio has contracted with Gatch & Gray, of this place, and L. G. Hallack & Co., of Wheeling, W. Va., for the foundations and approaches for the new bridge over Grave Creek in place of the one washed away by the flood last August.

Newark, N. J.—It is stated that there will be no further trouble between the city and the Lehigh Valley Railroad or the Morris Canal Co. over the replacing

of the wooden bridge over the canal on Broad street, and that the present one will be immediately replaced by an iron structure, designed after the latest patterns of bridges, with an asphalt roadbed.

New Brunswick, N. J.—The vote on the question of building a bridge between Perth Amboy and South Amboy shows that the plan was defeated by a majority of 2,024.

New York.—The new Board of Directors of the New York and New Jersey Bridge Company, of New Jersey, has elected the following officials: Everett M. Culver, President; George T. Werts, Vice-President; George B. Magoun, Secretary and Treasurer. Messrs. Robert Sewell and Benjamin Wright have been elected Counsel. The other members of the board are: D. E. Culver, Dr. Albert Le Dhu, William G. Bumstead, E. G. W. Woertz, J. G. Borgstede, A. G. Hupfel, Charles A. King, William Forster and James T. Sparkman.

Pittsburg, Pa.—A resolution has been introduced in Councils authorizing the Department of Public Works, E. M. Bigelow, Director, to have plans prepared for strengthening or rebuilding the bridges crossing the Pennsylvania Railroad. It is stated that since the Consolidated Traction Co. has secured the rapid-transit lines through the city it has been found that the bridges are too frail for the cars. Hence the company now offers to rebuild the bridges so that they will correspond with the width of the streets, pave them with asphalt and make them permanent structures. The cost will be about \$11,000 a bridge, or possibly \$35,000 in all. The Traction Company will pay two-thirds of the expense, and asks the city to pay the other third.

The Keystone Bridge Works has been awarded the contract for 13 steel viaducts for the Butler & Pittsburg. Many of these are for approaches to bridges crossing the principal streams along the new Carnegie line, while a few will be for temporary structures over ravines which will be finally filled up.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

The Supreme Court of the United States holds that the question of what constitutes an undue preference or advantage under the third section of the act is a question not of law, but of fact; and, before the commission can adjudge that a carrier has acted unlawfully, it must ascertain the facts. In so doing it must consider, among others, those facts and matters which carriers, apart from the statute, would treat as calling for a preference or advantage in the particular case.¹

In the same case the court says that in considering questions of the reasonableness of rates, the commission is to consider not only the wishes and interests of the shippers and merchants of large cities, but also the desire and advantage of the carriers in securing special forms of traffic, and the interest of the public that the carriers should secure that traffic, rather than abandon it, or not attempt to secure it.¹

In the Federal Court it is held that in the absence of a decision upon the question by the Supreme Court of the state, the court will follow the decision of the Supreme Court that railroad mortgages are not within the purview of state statutes regulating mortgages of chattels.²

And that a judgment against a railroad for personal injuries is not entitled to payment out of moneys in the hands of a receiver before bonds secured by a previous mortgage.³

The Federal Court holds that after the institution of a suit to foreclose a mortgage covering all the property and net earnings of a railroad company no lien on such earnings can be acquired by a general creditor.²

The Supreme Court of the United States declares that the Interstate Commerce Act discloses no purpose on the part of Congress to reinforce the provisions of the tariff laws or to co-operate with the assumed policy thereof, and no support can be derived from this view of the act, for a rigid general order of the Commissioners requiring goods brought from foreign countries under through bills of lading to be carried from the seaboard to interior points at the same rates charged on domestic traffic originating in the seaboard cities.¹

In New Jersey it is held that an ordinance prohibiting the placing of salt of any kind on any street-railway track, or other part of the street within a city, except on curves of railways leading from one street into another running at right angles therewith, is a reasonable regulation for the common use of the street for a street rail way and for ordinary travel.⁴

In the same case it is laid down that the state legislature, in authorizing a street railway company to make use of public streets, did so subject to the subordinate power of municipal corporations to enact such ordinances as do not unreasonably interfere with the exercise of the franchises granted.³

Injuries to Passengers, Employees and Strangers.

In Texas it is held that where a railroad ticket agent orally agreed to sell the plaintiff a return-trip ticket good for 30 days, received the money therefor and delivered the ticket, and plaintiff soon afterward found that it was limited to 10 days and demanded a change in the ticket or a return of the money, but was refused, the company could not defend an action for ejecting plaintiff's wife while subsequently riding on the return coupon after 10 days, but within 30, on the ground that the breach of the contract, if any, took place when the agent refused to change the ticket or return the money, and that the subsequent attempt to ride on the return coupon was at the passenger's risk.⁴

In Texas in an action by a servant for personal injuries alleged to have been caused by the want of a brake on a hand-car, it appeared that plaintiff and the gang with which he worked were accustomed to use the defective hand-car and another in going to and from their work. Plaintiff, on discovering the defect in the car, requested and was allowed to ride upon the other car, and some time thereafter was injured while riding on the other car, which was in front of the defective one, by reason of the defective car running into the car on which he was riding; the men on the defective car being unable to control its movements on account of the want of a brake. The Supreme Court rules that the plaintiff did not, as a matter of law, assume the risk of injuries in such manner.⁵

In Missouri it is held that where a rule of a railroad permits employees to go between cars moving at a slow and safe speed, to make couplings, it was not contributory negligence, as a matter of law, for a brakeman to go between cars moving at a rate of from three to four miles per hour, there being evidence that that was a safe rate of speed, and that said brakeman did not have time to uncouple the cars while the train was standing still, though he was in control thereof.⁶

In the Federal Court it is declared that a railroad employee who, upon becoming a member of a voluntary relief association, composed of employees, and to whose funds the railroad company is bound to contribute in case of deficiency, signs, without fraud or undue influ-

ence, a contract that in case of injury he shall elect either to take the benefits provided by the association or have his action against the company, cannot avoid the effect thereof on the ground that he signed the agreement without reading it or understanding its purport, and that he was at a disadvantage in dealing with the company.⁷

In Kansas one who solicits and obtains employment as a brakeman, though he makes known the fact that he is wholly inexperienced in that occupation, cannot charge the company with injuries resulting from his inexperience.⁸

In Arkansas in an action against a railroad company for the death of an employee, it appeared that deceased was working in defendant's yards on the track; that he was prevented from hearing a switch engine's approach by the noise of another engine, and that both the fireman and the engineer on the switch engine saw deceased when 40 yards from him, and noticed that he was apparently unaware of their approach. There was evidence that no sufficient effort was made to stop the engine, and that the engineer was guilty of carelessness. The Supreme Court rules that, though deceased was negligent, the evidence justified a verdict for plaintiff.⁹

In Texas deceased was under a car on a sidetrack used exclusively for storing cars needing repair. He and his fellow-workmen had pushed other cars, standing between it and the switch, nearer the switch. It was necessary to move such cars to make such repairs. An engine properly on the lead track struck the car nearest the switch, because it was too near, driving it and the other cars against the one on which deceased was at work, killing him. Defendant had no rules for the protection of repairers at work on such cars. The Supreme Court holds that whether defendant was negligent in failing to have reasonable rules to protect its employees repairing cars on such sidetrack was for the jury.¹⁰

In New York where a railroad published a rule requiring conductors to look after switches used by their engines, it was not liable for the death of a conductor, caused by the failure of another conductor, who knew of the rule, to properly adjust a switch after using it.¹¹

In Texas it is ruled that plaintiff was not chargeable with notice of latent defects in the apparatus connected with a water tank, merely by reason of having used it daily.¹²

In Massachusetts, in an action against a railroad for the death of plaintiff's decedent, it appeared that a sleeping-car and two coaches were left standing on a sidetrack, with brakes sets, the rear car being about three feet from the bunting post; that a switch engine backed down, pushing some cars, one of which was to be coupled to the standing cars, and struck them with such force as to drive the rear car against the post, whereby decedent was caught between the car and the post as he was passing between them with pails of water, to be put into the tank of the sleeping-car. The Supreme Court rules that since the most direct and convenient route for decedent to have taken in bringing the water was through the space between the car and the post, he was not, as a matter of law, guilty of contributory negligence.¹³

In Montana in an action for death of plaintiff's decedent—the foreman of the switching crew in defendant's yards—it appeared that the switching engine having got out of order decedent procured a common road engine, the use of which was more hazardous than the use of a switch engine. The danger of using a road engine, though, could have been greatly obviated by placing a flat car in front, and decedent had authority to do so without orders from any one. Decedent, in attempting to uncouple a car from the engine, in order to make a flying switch, fell from the pilot of the engine, on which he was standing, and was run over by the cars following the engine. There was evidence that it was not necessary to make flying switches at the point where the switch was being made, due to the grade of the track, and that such switches had been positively prohibited at that point. The Supreme Court rules that a finding that decedent was guilty of contributory negligence would not be disturbed.¹⁴

In Tennessee, in an action for personal injuries, it appeared that plaintiff was required to uncouple defendant's train, and that, owing to a defective drawbar, his hand was mangled; that the conductor in charge, as well as the one who turned the train over to him, knew of the defective car, but that plaintiff did not; that the car was apparently sound; and that the defect was not discernible by ordinary observation. The Supreme Court decides that plaintiff was not chargeable with negligence.¹⁵

In Pennsylvania, plaintiff, while waiting in the dark upon a disused path running parallel with defendant's railroad, was frightened by an approaching train, and was injured in attempting to avoid an obstruction placed on the path by defendant, but it appeared that if he had remained on the path he would not have been injured. The Supreme Court rules that the proximate cause of the injuries was not defendant's negligence.¹⁶

In Ohio plaintiff stepped off an electric car, crossed the track behind it, and, in attempting to cross the parallel track, was struck by a car running in the opposite direction. The conductor on whose car he had ridden knew of his attention to alight, but gave no warning of the approach of the other car, nor was the bell of that car rung, though it was running at the unusual speed of 20 miles per hour. The Supreme Court rules that plaintiff was not guilty of contributory negligence as a matter of law, in failing to stop and look down the track before attempting to cross.¹⁷

In Virginia it is held that recovery may be had for the death of a trespasser, killed while sitting on a railroad track, though he was guilty of contributory negligence, if those in charge of the train could, after discovering his peril, by proper care and due diligence, have avoided the accident.¹⁸

1. T. & P. v. I. C. Com., 16 S. Ct., 666.
2. Farmers' L. & T. Co. v. Y. D. B. C. & A., 71 Fed. Rep., 29.
3. C. T. Co. v. Elizabeth, 34 Atl. Rep., 146.
4. G. C. & S. F. v. Halbrook, 33 S. W. Rep., 1028.
5. Int. & G. N. v. Williams, 31 S. W. Rep., 161.
6. Hollenbeck v. M. P., 34 S. W. Rep., 494.
7. Vickers v. C. B. & Q., 71 Fed. Rep., 139.
8. McDermott v. A. T. & S. F., 43 Pac. Rep., 248.
9. K. & A. V. v. Fitzhugh, 33 S. W. Rep., 960.
10. Cumpston v. T. & P., 33 S. W. Rep., 737.
11. Davis v. S. I. R. T., 37 N. Y. S., 157.
12. M. K. & T. v. Gordon, 33 S. W. Rep., 684.
13. Murray v. Pittsburgh, 43 N. E. Rep., 190.
14. Thompson v. M. C., 43 P. 496.
15. L. & N. v. Reagan, 33 S. W. Rep., 1050.
16. Grimmer v. P. R. R., 34 Atl. Rep., 210.
17. Cin. St. R. v. Snell, 43 N. E. Rep., 207.
18. Seaboard & R. v. Joyner, 23 S. E. Rep., 773.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Chicago & Alton, quarterly, 2 per cent. on common and preferred stock, payable Dec. 1.

Cleveland & Pittsburgh, quarterly, 1½ per cent., payable Dec. 1.

Manchester & Lawrence, 5 per cent., payable Nov. 2.

Nashua & Lowell, 4½ per cent., payable Nov. 2.

North Pennsylvania, 2 per cent., payable Nov. 25.

Pennsylvania, 2½ per cent., payable Nov. 30.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Baltimore & Ohio Southwestern, annual, Central Trust Co., New York, Nov. 19.

Buffalo, Rochester & Pittsburgh, annual, Union Trust Co., New York, Nov. 16.

Lehigh Valley, annual, J. R. Fanshaw, Philadelphia, Pa., Nov. 17.

Richmond, Fredericksburg & Potomac, annual, J. B. Winston, Secretary, Nov. 10.

St. Paul & Northern Pacific, special, St. Paul, Minn., Nov. 20.

Santa Fe, Prescott & Phoenix, annual, Prescott, Ariz., Nov. 18.

Savannah, Florida & Western, annual, Savannah, Ga., Nov. 24.

Ulster & Delaware, annual, Rondout, N. Y., Dec. 6.

Wilmington & Weldon, annual, Wilmington, N. C., Nov. 18.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Railway Signalling Club* will meet on the second Tuesday of the months of January, March, May, September and November, in Chicago.

The *Western Railway Club* meets in Chicago on the third Tuesday of each month, at 2 p. m.

The *New York Railroad Club* meets at 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Tuesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the second Friday of January, March, May, September and November, at 2 p. m.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November.

The *Northwestern Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, at 8 p. m.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month, at 8 p. m.

The *Western Society of Engineers* meets in its rooms on the first Wednesday of each month, at 8 p. m., to hear reports, and for the reading and discussion of papers. The headquarters of the Society are at 1736-1739 Monadnock Block, Chicago.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m., except during July and August.

The *Denv'r Society of Civil Engineers* meets at 3 Jacobson Bock, Denver, Col., on the second Tuesday of each month except during July and August.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7:30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday, at 8 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month, at 7:30 p. m. Address P. O. Box 333.

The *Engineers' and Architects' Club of Louisville* meets in the Norton Building, Fourth avenue and Jefferson street, on the second Thursday each month at 8 p. m.

The *Western Foundrymen's Association* meets in the Great Northern Hotel, Chicago, on the third Wednesday of each month. S. T. Johnston, Monadnock Block, Chicago, is secretary.

The *Engineers' Club of Columbus*, (O.), meets at 12½ North High street, on the first and third Saturdays from September to June.

The *Engineers' and Architects' Association of Southern California* meets each third Wednesday of the month in the Hall of the Chamber of Commerce, Los Angeles, Cal.

The *Engineers' Society of Western New York* holds regular meetings the first Monday in each month, except in the months of July and August, at the Buffalo Library Building.

The *Civil Engineers' Society of St. Paul* meets on the first Monday of each month, except June, July, August and September.

The *Engineers' Society of Western New York* meets on the first Monday of each month at the Society's rooms in the Buffalo Library.

The *Boston Society of Civil Engineers* meets at 715 Tremont Temple, Boston, on the third Wednesday in each month, at 7:30 p. m.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas place, St. Louis, on the first and third Wednesdays in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Engineers' Society of Western Pennsylvania* meets at 410 Penn avenue, Pittsburgh, Pa., on the third Tuesday in each month, at 7:30 p. m.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Association of Engineers of Virginia* holds informal meetings on the third Wednesday of each month from September to May, inclusive, at 710 Terry Building Roanoke, at 8 p. m.

New York Railroad Club.

The next regular meeting of the New York Railroad Club will be held at the rooms of the American Society of Mechanical Engineers, No. 12 West Thirty-first street, New York, at 8 p. m., Thursday, Nov. 19. Mr.

Curtis W. Shields will read a paper on "Compressed Air: Its Generation, Transmission and Application, with Especial Reference to its Use in Railroad Shops."

Civil Engineers' Society of St. Paul.

A regular meeting of the Civil Engineers' Society of St. Paul was held on Nov. 2, 10 members and six visitors present. The discussion of the evening was led by Mr. H. H. Vaughan, M. E., of the Great Northern Railway Company, and was suggested by incidents of a recent visit to the shops of the company by 14 members of the society. These shops are equipped with laboratories for mechanical and chemical tests and pneumatic appliances are in general use in the various departments.

Civil Engineers' Club of Cleveland.

The regular meeting of the club was held Tuesday evening, Nov. 10, at 7:45 p. m. The paper of the evening was presented by Joseph R. Oldham, on "Structural Strength of Ships and Improved Arrangements for Repairing without Diminution of Strength." The subject was treated under 13 different heads, among which were the following: Bending moment and shearing stress; strength of beams and girders; straining of ships; moment of inertia; useful weak ships; heavy ships; light ships, and a perfect mechanical structure.

Chicago Electrical Association.

The Chicago Electrical Association met Nov. 6, at Room 1,737, Monadnock Block, Chicago. Mr. F. S. Hickok read a paper entitled, "Metric System in Electrical Industries." The paper was discussed by Messrs. F. A. Muschenheim, S. G. McMeen, Albert Scheible and C. Wiler, the latter having had experience with the metric system in Germany. Current topics were introduced for discussion by Mr. J. M. Hollister. The next meeting will be held Nov. 20, when Mr. E. L. Andrews, Engineer for the American Telegraph & Telephone Co., will present a paper, "Daily Problems in Long Distance Telephoning."

Engineers' Club of Philadelphia.

A regular meeting of the club was held Nov. 7. The papers were: "The Queen Lane Division of the Philadelphia Water Supply System—the Distributing System," illustrated by lantern slides, by Allen J. Fuller, and "Rapid Methods in Instrumental Drawing," illustrated by lantern slides, by L. F. Rondinella.

At the meeting of Oct. 17, Mr. Elmer G. Willyoung presented a communication upon the "Roentgen Phenomena—Theory and Practice," and Dr. H. M. Chance presented a paper upon "Electricity in Gold Milling."

At the invitation of the President, Mr. Dexter Brackett (visitor), of the Metropolitan Water Board of Massachusetts, gave a brief description of the work that has been done by the State of Massachusetts for supplying Boston and neighboring towns with pure water, which great work we have described at some length heretofore. At the close of Mr. Brackett's remarks, Mr. John C. Trautwine, Jr., called attention to the fact that Pennsylvania is peculiarly fitted for a State supply, or one under an interstate commission, having absolute control of the waste or timbered water-bearing lands, so as to protect them from pollution and forest devastation. Massachusetts seems to lead the way in matters of education and politics, and Pennsylvania should gladly accept this object lesson from the pioneer State.

Engineers' Club of St. Louis.

The club met on Nov. 4, 26 members and four visitors present.

Mr. M. L. Holman presented informally the proposed specifications and form of contract prepared by the Board of Public Improvements for the lighting of the streets and public places of St. Louis for a term of 20 years, beginning in 1900. The most important features of the proposed contract were the exclusive use of 32 candle-power incandescent lights in place of the arc lights of 2,000 nominal candle-power, all wires to be underground.

St. Louis was the first large city to adopt electric lighting on a large scale, and has therefore had a wide and valuable experience, arc lights being used for the streets generally and incandescent lights for the alleys, parks and streets.

Discussion followed by Messrs. R. E. McMath and B. H. Colby, who with Mr. Holman formed the sub-committee of the Board which had this work in hand. They emphasized the fact that their conclusion was based upon actual observations made on the two systems of lighting in regular service in this city. The arc lights give a very unequal distribution, the illuminations being very intense at one point and there being but little light midway between. The incandescent lights on the other hand, are placed much nearer together and afford a much more uniform light.

Further informal and general discussion followed in which Messrs. Robt. Moore, Eavys, Crosby, Barth, Van Ornum, Ockerson, Pitzman, Wise and Philip Moore participated.

PERSONAL.

—Mr. Hugh J. Jewett, formerly Receiver of the Erie Railroad, is dangerously ill at his summer home, near Havre de Grace, Md. Mr. Jewett is 81 years of age.

—Mr. George C. Gorham, of Washington, who for many years was Secretary of the United States Senate, has been elected a Vice-President of the Northern Pacific Railroad.

—Mr. Charles E. Weymouth, who has been Chief Clerk in the Auditing Department of the Southern Pacific road, has been promoted to the position of Assistant Auditor, headquarters at New Orleans.

—Mr. W. G. Neimeyer, General Agent of the Southern Pacific in Chicago, has been appointed agent of the Pacific Mail and the Occidental and Oriental Steamship companies for Chicago in addition to his present office.

—Mr. Charles G. Hedge, Controller, Secretary and Treasurer of the Missouri, Kansas & Texas has been elected Vice-President in charge of the financial and accounting departments. The office of Controller is abolished.

—Mr. H. Walter Webb, Vice-President of the New York Central & Hudson River road, is confined to his home by illness, but is now reported as being much improved in health. He will, however, not resume his duties for some time.

—Mr. Andrew Stevenson, Commercial Freight Agent of the Baltimore & Ohio Railroad at Baltimore, has been appointed Division Freight Agent of the road. He went to the Baltimore & Ohio from the Cincinnati, Chicago & St. Louis.

—Mr. R. L. Vernon, Agent at Greensboro, N. C., a junction of four divisions of the Southern Rail-

road, for over 25 years, has been appointed Traveling Passenger Agent of the Southern, with headquarters at Charlotte, N. C., relieving Mr. Charles L. Hopkins, who has been transferred to San Francisco as Pacific Coast Passenger Agent of the Southern.

—The Great Northern Railway (England) is about to lose the services of Mr. Richard Johnson, the Engineer-in-Chief, who has just sent in his resignation to the directors. Mr. Johnson is a very old official and has steadily won his way in the company. He began his railway career as a mechanic and has seen nearly 50 years of service. The resignation will take effect at the end of the year.—*Transport*.

—Mr. Samuel A. Beardsley, of Utica, State Railroad Commissioner of New York, has handed his resignation to Governor Morton. Technical questions arose during the summer as to the precise date when Mr. Beardsley's term as Railroad Commissioner expires, which finally went before the Attorney General of New York, who decided that it would expire in February, 1897. It is not publicly known when Mr. Beardsley's resignation takes effect. His friends give Dec. 31 as the date, the resignation, it is said, having been handed to Governor Morton when the question as to the termination of his term was still unsettled.

—Mr. William J. Dale, Railroad Commissioner of Massachusetts, whose illness was noted last week, died in Springfield, Mass., Nov. 5, of Bright's disease. He was stricken on Oct. 11 while the Commissioners were on their annual tour of inspection. He was born in Boston, April 15, 1850, and was the son of Dr. William J. Dale, a distinguished physician, who was Surgeon-General of Massachusetts for nearly twenty years. He was Assistant Postmaster of Boston, and in 1891 was Secretary of the Democratic State Committee. In November of that year he was appointed to the Board of Railroad Commissioners by Governor Russell.

—Mr. J. Waldo, Vice-Chairman of the Southwestern Traffic Association, died at St. Louis, on Nov. 7, after a brief illness. Mr. Waldo was one of the best known traffic managers in the Southwest, and had only recently been elected a Commissioner of the new Southwestern Traffic Association. For the last few years he had been Receiver and later President of the Galveston, La Porte & Houston road, a new line between Houston & Galveston. He was for many years identified with the Houston & Texas Central road, and, beginning as a freight clerk on that line, became Vice-President and General Manager. He resigned in 1885, and for several years was Commissioner of the Texas Traffic Association. Then he went to the Missouri, Kansas & Texas as General Traffic Manager and became First Vice-President of that company, resigning in 1892.

—Mr. John H. Inman, a wealthy and well-known business man of New York City, particularly identified with the cotton trade and Southern industrial enterprises, died suddenly in the Berkshire Mountains Nov. 5. Mr. Inman had been connected with business enterprises in New York City since the Civil War, through which he served in the Confederate army. He engaged in the cotton trade and acquired wealth, much of which he invested in railroad, coal and iron properties in the Southern States. He was very prominently identified with the early history of the Tennessee Coal, Iron & Railroad Co. About 1883 he became interested in Southern railroads and was a Director of the East Tennessee, Virginia & Georgia, the Louisville & Nashville, the Nashville, Chattanooga & St. Louis, the Richmond & Danville, and was one of the chief spirits in the organization of the Richmond & West Point Terminal Co., of which he was for a time President. He was a member of the Board of Rapid Transit Commissioners in New York.

—Mr. John M. Egan has been elected Vice-President of the Central of Georgia and will have his headquarters at Savannah, Ga. Mr. Egan is now General Manager of the Lake Superior & Ishpeming road, a short but important new road in the mining districts of the Upper Peninsula of Michigan. He has had charge of the building of this road for a year or more past. Mr. Egan has long held important railroad positions in the West, in which he has been prominently brought before the public as well as railroad men. He was for many years President of the Chicago Great Western, and during the Debs strike was the Agent of the General Managers' Association at Chicago. After serving his time as a machinist, Mr. Egan entered the engineering department of the Northern Missouri in 1871, and was then with the Southern Minnesota, now a part of the Chicago, Milwaukee & St. Paul, as Chief Engineer and Superintendent. In 1882 he became General Superintendent and Superintendent of Construction of the Western Division of the Canadian Pacific. He resigned in 1886 to accept a similar office on the St. Paul, Minneapolis & Manitoba, and while he held this position the Manitoba extension from Dakota to Great Falls, Mont., was built, so that it is doubtful if any other man has superintended the building of more miles of railroad. In 1888 he became General Manager of the Chicago, St. Paul & Kansas City road, and in 1891, when the Chicago Great Western was organized as the successor of that line, he was elected President, and held both offices until April, 1894. An incessant worker, an excellent organizer, with a buoyant and cheerful temperament and a long and varied experience, Mr. Egan has filled every office he has held with ability and success, and has won the good will of his men to an unusual extent.

ELECTIONS AND APPOINTMENTS

—Baltimore & Ohio.—James H. Maddy has been appointed Press Agent of this road, with headquarters at Baltimore.

—Central of Georgia.—The adjourned annual meeting of the stockholders was held Nov. 10 and elected the following directors for the ensuing year: H. M. Comer, of Savannah; John M. Egan, of Marquette, Mich.; E. P. Howell, of Atlanta; U. B. Harrold, of Americus; G. M. Williams, of Columbus; J. E. Hanson and S. R. Jacques, of Macon; Patrick Walsh, of Augusta; Geo. J. Mills, Joseph Hull and A. Vetsburg, of Savannah; Geo. G. Haven and Charles Steel, of New York. A resolution was passed providing that application for an amendment allowing 15 directors be made to the Secretary of State of Georgia, and as soon as that is done the two other directors will be chosen by the Board. One of them will be President Samuel Spencer, of the Southern Railway, and the other a Southern man. John M. Egan was elected Vice-President.

—Linville River.—This new company, in North Carolina, has been organized by the election of the following officers: W. W. Denning, President; A. B. Camp, Vice-President and General Manager, with headquarters at

Montezuma, N. C.; Chief Engineer, F. G. Phillips, Knoxville, Tenn.

—Missouri, Kansas & Texas.—At a meeting of the Executive Committee of the Board of Directors, Oct. 30, Charles G. Hedge was elected Vice-President, in general charge of financial and accounting departments. Officials and employees heretofore reporting to the Controller will now report to the Vice-President and Treasurer. The office of Controller has been abolished.

—Rio Grande & Eagle Pass.—Felix Murphy has resigned the position of Auditor and Charles Fraser succeeds him.

RAILROAD CONSTRUCTION INCORPORATIONS, SURVEYS, ETC.

—Bellefonte Central.—The line which is completed to within one mile of Pine Grove Mills, Center County, is rapidly being pushed into the town. A large number of men and teams are now employed in grading that part of the road, which will be finished in a short time and then the ties and iron will be laid.

—Butler & Pittsburgh.—The contract for the Union Bridge, crossing the Monongahela River at Bessemer to a point opposite near Homestead, will soon be let. The Carnegie Steel Company controls the Union Railroad, the terminus of the Butler & Pittsburgh, and the bridge, and a short section of road in the lower part of the works in the town of Homestead are all that remain to be completed. The work on the Butler & Pittsburgh is assuming some shape. The bridge across the Allegheny River has also been started, and the foundation is being laid. Nothing has been done toward letting the contract for the connecting link between the bridge and the Union Railroad. The company has done nothing toward entering the city of Pittsburgh so far, and has made no overtures to the railroads now located. Only one more piece of ground will have to be secured in Homestead to secure the right of way from the Carnegie steel works in Homestead to Six-Mile Run, to connect with the first pool mines, the objective point.

—Canadian Roads.—Deputy Minister of Railways and Canals Schrieber has gone to British Columbia to make a report upon the advisability of building the proposed Crow's Nest line from Lethbridge, on the Canadian Pacific, through the Crow's Nest Pass into the Rocky Mountains and into the Kootenay mining region in British Columbia.

—Chesapeake & Ohio.—A branch from Olympia, Va., to the new mines of the Bath County Iron Company will be constructed at once, and the iron company announces that the mines will be opened.

—Chicago, Hammond & Western.—This new belt-road, at Chicago, which is now completed and in operation from Whiting, Ind., to McCook, where it joins the Atchison, Topeka & Santa Fe, is to be extended at once to meet the Chicago & Northwestern.

—Coast Railway of Nova Scotia.—The company has about 500 men at work near Yarmouth, and is pushing the work with all possible dispatch. The rails will be laid as far as Pubnico by the end of December. The company is constantly adding to its rolling stock and will be in a position to do a large traffic as soon as the rails are laid. The road will be open as far as Belleville for business shortly.

—Cumberland Valley.—The company will probably soon begin active construction work on its proposed branch from Richmond Furnace to Mt. Dallas and on a connection with the Bedford division of the Pennsylvania. The company some time ago acquired possession of the old South Penn rights of way under condemnation proceedings and has made the needed surveys for the new road to be built. Some attention has also been paid to the several tunnels along the route in various stages of completion. One of the tunnels has been drained, but the others are in a more or less damaged state. It would take about eighty or more miles of track to complete this new line, which would also extend to another connection with the road at or near Newville. Coal shipments, now sent to Huntingdon over the independent Huntingdon & Board Top, would be diverted to the more direct new line, being transferred to the Pennsylvania at Harrisburg.

—Denver & Rio Grande.—Local newspapers state that surveyors who have been working for the past six months west of La Veta, Colo., trying to gain a more feasible route than Veta Pass, have made connections on both sides of the range with the present line and claim to have found a route much easier to climb the range than anything heretofore tried. The survey leaves the present line on the west side of the range about six miles below Placer, in Costilla County, and follows up Wagon Creek to its head, and then comes down Middle Creek on this side of the range and connects about a mile and a half west of La Veta. This route has the advantage of not being snowbound all winter, as it is not so high as Veta Pass and the snow melts quicker than on the present line.

—Florence & Cripple Creek.—The work of grading the roadbed of the Golden Circle road is progressing rapidly and the contract has been let for furnishing ties, and the rails and rolling stock have been purchased in Chicago. The new road is being promoted by private capital, but will connect with the Florence & Cripple Creek Railroad at Victor, Colo., and be operated under its management. The object of the road is to reach the point of transportation on Bull Hill and the other elevated mining sections contiguous thereto, from which mineral at the present time has to be hauled by wagon to local sampling works or railroads.

—Florida Western.—About 150 men are now at work on the grading and 50 men clearing right of way. The road is to be built from Apalachicola, Carrabelle, Tallahassee and Centreville to Thompsville, Ga. The location is complete, and the right of way, with few lapses, secured. The company is doing its own work, and two miles of grading has been completed, since work began Oct. 15. The lower section is sand with 4,500 yds. excavation to the mile on the average; the upper section is clay with 10,000 to 15,000 yds. to the mile. A drawbridge and trestle will be built at Apalachicola, and a drawbridge and trestle at Carrabelle. R. L. Bennett, of Tallahassee, is Chief Engineer.

—Great Northern.—The Hope extension is now ready for trains from Hope to Aneta, N. Dak., 30 miles. This line will open a new field in Southern Nelson County, one of the most fertile parts of North Dakota. Aneta and Walker are the principal towns on the new line, although there are several smaller ones. The Halsted ex-

tension was opened a few days ago, and trains put on between Crookston and Moorhead. A fertile part of the Minnesota side of the Red River Valley is tapped by this line, and the two branches will bring a large wheat traffic to the Great Northern.

Gulf & Brazos Valley.—The railroad committee in Jack County, Tex., has closed a formal contract with the officers of this company by which the railroad is advanced a bonus of \$25,000 in cash, right of way through Jack County, station grounds in Jacksboro, and an advance of \$1,250 cash for engineering and general expenses. H. M. Berry and a party of engineers are to make a survey through Jack County to Jacksboro immediately.

Kansas City, Pittsburgh & Gulf.—On Thursday President A. E. Stillwell said, in an interview at Kansas City, "We will put 1,500 more men on the construction of the railroad at once. We began laying track south of Mona, Ark., yesterday at the rate of three-fourths of a mile a day."

Maine Central.—The second track between Bangor and Old Town, Me., 13 miles, which has been building all summer, was completed to Webster, 11 miles from Bangor, and the work has been discontinued for the season.

Marshfield & Southeastern.—The reports published in the local papers, that this company would soon undertake important new construction work, are not confirmed. They have this basis, that a survey has been made from the present terminus at Port Edwards, to Princeton, Wis., a distance of about 55 miles, and has been voted by the towns along the line, but no work has yet been done or contracts let.

Michoacan & Pacific.—Mr. L. R. Gordon, General Superintendent, has just completed a reconnaissance of the company's projected new line between Queretaro, in the Guadalajara branch of the Mexican Central, to Ario, 250 km., passing the towns of Tinguindin, Zamora, Uruapan, Taretan and Ario. The line from Maravatio to Tuxpan, the present terminus, will be extended to Zitacuaro, a distance of 38 km., within one week's time, and it is expected that this work will be terminated next March. Then construction on the projected line above referred to will be commenced.

Norfolk & Western.—It is announced that options have been secured on right of way from Kenova to Huntington, W. Va., five miles, for an independent branch, thus gaining a direct entrance to the city, and reaching with its own line a number of large manufacturing plants. Freight and passengers are now transferred to the Chesapeake & Ohio and Ohio Valley roads for a four-mile haul. It is also announced since the election that the Norfolk & Western will again begin work on its shops and terminals at Kenova, begun about three years ago and suspended. The yards at Ceredo are also to be extended and improved. The company is also improving the roadbed and bridges on the West Virginia Division.

Northern Adirondack.—Surveys for the projected road, between North Creek and Long Lake, the Adirondack region of New York, were begun this week under Chief Engineer Anthony.

Nova Scotia Southern.—The company has let the contract for the entire construction work to the Nova Scotia Construction Company, Thos. Murray, Manager. This company will push the construction and expects to have the track laid to Indian Gardens in the spring.

Omaha Bridge & Terminal Co.—John R. Webster, Assistant General Manager, states that the company will immediately proceed to carry out the improvements contemplated and conditionally contracted for some time since. They will involve, approximately, the expenditure of \$500,000, and will include connections with all roads entering Omaha, South Omaha and Council Bluffs, the building of freight depots, etc. At present the terminal company is handicapped in transferring from one road to another as regards several of the roads. The largest single improvement on the Omaha side of the river will be the construction of a connecting line with the Missouri Pacific. It will begin in East Omaha on a line but half a mile north of the group of factories, and will have a grade sufficient to cross the railroad yards north of Locust street and east of Sherman avenue on a viaduct. The viaduct will be of steel, and will cost \$100,000.

Ottawa, Arnprior & Parry Sound.—The final inspection of this road from Ottawa to Scotia, Ont., where the line connects with the Grand Trunk, has been made. To complete the line to Parry Sound there remains to be constructed the bridge across the Sound and nearly four miles of track beyond, to the terminus at deep water on Georgian Bay. This track cannot be laid until the bridge is completed.

Philips & Rangeley.—The engineers, in charge of C. F. Hilton, have completed a location of a branch line from Dead River Station, Me., five miles, from Rangeley Lake to Kennebago Lake, a distance of 7½ miles. A very direct line with light curves was found. The work will not be heavy.

Pittsburgh & Eastern.—Work on this new line, which was stopped some time before election, will now be pushed. There is no truth in the report that the line will be changed so as to connect with the New Butler & Pittsburgh. All arrangements have been completed to run the Pittsburgh & Eastern to West Newton, where it will connect with the Pittsburgh, McKeesport & Youngstown. John Pitcairn, President of the company, is authority for the statement. The contract for 14 miles of grading will soon be let to continue the work from Mehaffey. Twenty-four miles of work are under way at present.

Point Pleasant, Buckhannon & Tygart's Valley.—It is announced that this company, organized in 1892, to build from the Ohio River, at Point Pleasant, to a connection with the West Virginia Central & Pittsburgh, near Belington, W. Va., has been reorganized, and is making preparations for putting its plans into effect. The proposed line will open a fine undeveloped coal, timber and grazing country and will serve as a feeder for four established roads.

Queen Anne.—The contract for building the line between Greenwood and Ellendale, Del., a distance of 10 miles, has been awarded to Wade, Burns & Co., of Baltimore, Md. This firm has been building the road from Queenstown, Md., to Greenwood, and will probably secure the contract to complete it from Ellendale to the terminus at Lewes, on the Atlantic Coast, a distance of 15 miles. The road is now finished to within a mile of Denton.

San Francisco & San Joaquin Valley.—The directors are now preparing to start work on the last division of the line beyond Fresno to carry the line to Bakersfield in Southern California, where a connection is to be made

with the Atlantic & Pacific. This division of the road will be built from the proceeds of an issue of bonds which the directors of the company are now arranging to issue. The line now built, that is, from Stockton to Fresno, is not bonded, the cost of the construction having been borne by the subscriptions to the stock.

Tennessee Central.—The injunction proceedings to secure an order to prevent Receiver C. O. Godfrey from continuing construction work on the road, have been dismissed. Receiver Godfrey made a report to the Court, on the condition of the road, in which he said that when the Receiver took charge of the line 21 miles of the grading and over one-third of the heavy tunneling were completed, that since that time he has constructed ten more miles of the line, about one third more of the tunneling and other miscellaneous work. The actual cost per mile of the first 21 miles of road was actually twice the cost of that graded under the receivership. The Receiver has changed the route for the line to Knoxville, and the line will not go through Roane County, which had voted bonds. A survey showed that the road could be constructed to Knoxville, at a light grade, with \$40,000 less expense for bridging, and eight miles less distance, by continuing the line through Harriman, which lessened cost would equal the entire subscription of Roane County.

Tennessee, Georgia & Atlantic.—A. E. Richards, the promoter of the road, says the line will be located between Athens and Augusta, Ga., by Nov. 10, and that the grading will be commenced not later than December. He has let the contract for the grading of the road from Athens to Sandy Creek, Oglethorpe County. It will be decided in a short while whether the new road will go by Washington or Danburg, the decision depending upon which town offers the largest subscription to the bonds of the road.

Texas Midland.—The extension to Paris, Tex., where an important connection with the St. Louis & San Francisco is secured, was opened for traffic Oct. 25, as announced at the time. The line adds 45 miles operated by the company. The route is via Commerce and Cooper. From Greenville to Commerce, 15 miles, this road uses the track of the St. Louis Southwestern. The extension was built from Commerce northeasterly through Cooper to Paris, 37.5 miles. The route is through one of the richest and best developed sections in the state. The country is rolling but not rough; the average excavation on the new line was 21,000 cu. yds. to the mile, but the roadbed is unusually wide 18 ft. on embankments and 26 ft. in cuts. Only 11,000 cu. yds. of the quantities was rock. The maximum grade is 1 per cent., but there is less than 1½ miles of it. The maximum curvature outside of yards is two deg. The ties are long leaf, all heart pine ties 3,000 to the mile. The rails weigh 70 lbs. to the yard, 60 feet long (there is 59 miles of this track in use). An officer writes: "The absence of half of the joints is very perceptible in running over this track, and we think the difference in maintenance will also be perceptible and that a decided advantage will result from their use." The wooden bridges on the new line are built of the best long leaf pine, and the culverts of Bois d'Arc timber of which it is said it never decays, and tests would seem to establish the claim. Mr. Martin Duvall the Chief Engineer of the company, has examined a number of pieces that have been partly in the ground and partly above for 50 years and there is no sign at any place on 20 sticks that the decay has begun to set in. Ballasting is now going on, and the officers expect within the next two years to have a road equal to any in the state. The policy of the President, Mr. E. H. R. Green, is to have equally as good or better than any of the connecting roads. The motive power used and the coaches are probably the best in the state, and it is his intention to keep everything fully up to the standard. Mr. F. W. Pratt, now Superintendent of the road, was formerly Chief Engineer of the Missouri, Kansas & Eastern, during its construction, and later General Manager of the Sherman, Shreveport & Southern.

West Virginia & Pittsburgh.—President Camden states in an interview that enterprises for the extension of this road and the development of coal and timber lands in West Virginia involving an investment of \$1,000,000 will be immediately carried out, the funds having been promised. Over 15 miles of railroad will be built, beginning at the present terminus at Camden, on the Gauley River, in Webster County, and extending to the mouth of Cherry River, in Nicholas County.

Electric Railroad Construction.

Baltimore, Md.—The contract for the extension of the new electric line of the Central Railway Co., in East Baltimore, was awarded to David E. Evans & Co. Oct. 26 and work was started Oct. 27. The old franchise of the company covered 6½ miles in the city and the new franchise covers 7 miles in the Eastern section. The rails are from the Pennsylvania Steel Co., which will be bonded by 9000 "Chicago" bonds. It is expected to have one-half of the entire line finished by the first of January. More than a mile of track has been completed. The City & Suburban Railway Co. will extend its Wilkins Avenue line from Brunswick street to Beachfield avenue as soon as the city erects a new bridge over Gwynns Falls. The extension will be about two miles in length.

Belleville, Ill.—The Belleville & St. Louis Electric Railway Co., which recently received a franchise to pass through East St. Louis, commenced to build the line from the Belleville terminus on Oct. 31. The road will probably be in operation within six months.

Boston, Mass.—The West End Street Railway Co. has laid double tracks on Mount Auburn street from the Cambridge line to Common street, in Watertown.

Carlisle, Pa.—Tracklaying on the extension of the electric line from Carlisle to Boiling Springs, a distance of six miles, was completed Nov. 6 and cars are now running. The right of way was secured the first of May and construction work was begun the first week in August.

Charleston, S. C.—The Secretary of State of South Carolina has granted a charter to the Charleston Electric Railway Co., of Charleston, to build and operate electric railroads in any portion of South Carolina, with Charles H. Dean and two other New York capitalists, two Baltimore capitalists and others as incorporators, with capital stock of \$200,000, with privilege of increasing it to \$1,000,000. The company has made application to the City Council of Charleston to build an electric line on a large number of the streets. The petition was referred to a special committee, which favorably decided upon the application. The company agrees to give a bond of \$5,000 to begin work within 10 days after the permit is granted. At present the citizens are dependent on horse cars for transportation.

Cincinnati, O.—The Cincinnati & Miami Valley Traction Co. has been incorporated with a capital stock of \$10,000 by Dennis Dwyer, John T. Wolf and others.

Cornwall, Ont.—The Cornwall Electric Street Railway Co. commenced work Nov. 5 on its extension to the mills of the Toronto Paper Co., a distance of about three quarters of a mile. It is stated that when the road is completed all the freight to and from the paper mills will be handled by the new line, the cars of which will be drawn by an electric locomotive.

Dallas, Pa.—A large force of men began work on the grading above Dallas last week and will push the roadbed to Harveys Lake before spring. It is the intention to have the line in operation by May next.

Danielsonville, Conn.—A franchise has been given to B. A. Daly, C. A. Porter, D. S. Simmons and others to build an electric road from Attawagan to Danielsonville and Mossup. George D. Moore and C. L. West, of Worcester, Mass., are interested in the project.

Delaware, O.—A company has been organized to build an electric road from Granville to Delaware, distance of about 30 miles, passing through Berkshire, Sunbury, Vans Valley, Johnstown and Alexandria. Right of way has been secured and the company expects to have the road in operation by Jan. 1, 1898. It is intended that the road shall be used for freight and passenger service.

Fayetteville, Ark.—The Fayetteville Electric Co. has filed articles of incorporation to build an electric railroad in Fayetteville. The incorporators are F. T. Trommett, O. N. Wallace and others. Capital stock, \$50,000.

Framingham, Mass.—The Framingham Union Street Railway Co. has been granted permission to use electricity as a motive power on its line between Framingham and Framingham Centre.

Glendale, S. C.—All the grading has been completed on the roadbed of the new electric line to be built from Spartanburg to Glendale, a distance of six miles.

Harwinton, Conn.—The committee, which was recently appointed to consider the best route for an electric road from Harwinton to Unionville, report that the road should run from Harwinton Center to the Burlington line, continuing east to the hill near side of Burlington, from there to Unionville.

Hoboken, N. J.—The Hoboken Railroad & Steamship Connecting Co. is laying tracks along Hudson street to connect with the steamship docks and warehouses in Hoboken. It is the present intention of the company to use the road for freight purposes only.

Johnstown, Pa.—The Johnstown Passenger Railway Co. will soon have its line completed from the upper end of the Eleventh Ward to Franklin Borough. Construction work has been going on for the past month.

Lima, O.—The Lima Electric Street Railway Co. was incorporated on Nov. 5, with a capital of \$200,000, by E. W. Moore, N. A. Gilbert, Adam T. Hill and others.

Liverpool, N. S.—The Liverpool & Milton Tramway Co., recently incorporated, proposes to build a railroad five miles long between Milton and Liverpool to be in operation by Jan. 1, 1897. For the present, steam will be used as the motive power, but electricity will be used as soon as the proper installation can be made. B. M. Hopkins, engineer of the road, informs us that it is the intention of the company to extend the road about 25 miles, surveys for which will probably be made this winter. The road will be used for both freight and passenger service. J. W. Moren is President and F. J. Hutchinson is General Manager of the road.

Palmer, Mass.—The Palmer & Brimfield Street Railway Co. has been organized with the following officers: President, N. S. Hubbard, Brimfield; Treasurer, R. V. Sawin; Directors, E. R. Pierce, E. G. Hastings and others. The line is to extend from Palmer to Brimfield, a distance of about six miles. The road will be built for passenger, freight, mail and baggage service.

Paris Mountain, S. C.—A charter has been granted to S. M. Grist, of Yorkville; W. J. Thackston, Greenville; W. F. Thackston, Frederick Hammond, A. G. Furman and others to build an electric railroad from Greenville to Paris Mountain, a distance of seven miles. The latter place is a new town which is being rapidly built up. The projectors propose to use it for both freight and passenger service.

Philadelphia, Pa.—The new electric road in West Fairmount Park will be opened this week. The East Park branch is to be finished next spring. For map see *Railroad Gazette*, Aug. 21, 1896.

St. Jerome, Que.—We are informed that the Northern Electric Railway Co. is applying to the Provincial Legislature for power to build an electric railroad from Montreal to St. Jerome.

St. Louis, Mo.—On Nov. 1, the Midland Street Railway Co. began to operate its new line extending from the Suburban tracks at Page avenue in a westerly direction to the Woodson road, a distance of nearly six miles. Surveys have already been made for the road to Creve Coeur Lake, a distance of seven miles from the present western terminus. Work upon the road was started in 1892, but was soon discontinued until recently.

Santa Monica, Cal.—We learn that the Pasadena & Pacific Railway Co. has secured a franchise to build an electric road in Santa Monica.

Tampa, Fla.—The preliminary survey for the Tampa & Palmetto Beach electric road has been completed, and it is expected that the work of grading over the marsh will soon be begun. This line will give a direct connection with East Tampa, known as Palmetto Beach.

Victor, Col.—Construction work has been begun on the electric road from Victor to Cripple Creek by way of Gillett, a distance of about 5 miles. Seventy and 90 lb. rails will be used.

GENERAL RAILROAD NEWS.

Atchison, Topeka & Santa Fe.—On Nov. 5 Judge L. H. Myers, of the District Court of Jefferson County, Kansas, under a petition filed by H. T. Phinney, County Attorney, appointed Charles F. Johnson, of Oskaloosa, Kan., Receiver of the real estate, including the railroad, buildings and appurtenances of this company, situated in the state of Kansas. The Receiver was authorized to enter into a contract with the company under which the company might continue to use and operate its property during the pendency of the action by paying a reasonable sum to the Receiver, and ordering that, in case the company failed to make such contract within five days after delivery of certified copy of the order,

the Receiver should take actual possession. The petition on which the order was granted is based upon an alleged act of the Legislature of Kansas which appears in the laws of 1891, known as the Alien Land act, and which in section 2 provides "That no corporation or association more than 20 per centum of the stock of which is or may be owned by any person or persons, corporation or association, not citizens of the United States, or of some district or territory thereof, shall hereafter acquire, hold or own any real estate in the state of Kansas." On Nov. 9 the Atchison attorneys filed a motion in the United States Circuit Court at Topeka to transfer the suit from the State Court to the United States Federal Court on the ground that the Alien Land act does not apply to railroads; that the appointment of a Receiver by the State Court would be an interference with interstate commerce and unconstitutional. The Attorney General of Kansas, under written direction of the Governor, took charge of the suit in the State Court, amended the petition and ordered a transfer to the United States Court. The question thereupon coming before Judge Foster, of the United States Circuit Court, at Fort Scott, he immediately entered an order restraining the Receiver from taking possession of the property or in any way interfering with its operation until Nov. 23, when he will hear the application of the railroad company for a temporary injunction on the motion to remove the Receiver. Atchison officials are not at all doubtful of the outcome of the proceedings. There are grave doubts whether the act in question was ever constitutionally passed. However this may be, the Atchison officials are firmly convinced that it is clear beyond a doubt that the act, even if constitutional, does not apply, and was never intended to apply to railroad companies; that the Legislature of Kansas has no power to subject the Atchison property to the operation of such a law and the whole proceeding, being an attempt to seize the property without notice and without hearing, is in violation of constitutional rights.

Atlantic & North Carolina.—President W. S. Chadwick announced this week that the directors have leased the road to the Goldsboro & Morehead City Railway Co., and has called a special meeting of the stockholders for to-day, Friday, Nov. 13. This notice was a surprise, as a meeting of the stockholders had been called last week by the President for last Monday, Nov. 9, to consider a proposition to lease the property. This meeting was afterward canceled, and it seems the directors subsequently took the responsibility of leasing the road without consulting the stockholders. The road extends from Goldsboro to Morehead City, N. C., over 100 miles, and is principally owned by the State of North Carolina, which has operated it successfully as an independent line; it is really an extension of the North Carolina road extending from Charlotte via Greensboro and Raleigh to Goldsboro, which is leased by the Southern, though the two roads have always been operated and managed by entirely separate officials, the state, however, owning a similar interest in each road—three-fourths of the stock. The company to which the road has been leased, is a new corporation, of which little is publicly known as yet, further than that Mr. A. Weil, of Goldsboro, N. C., is the leading spirit and that some of the private stockholders of the Atlantic & North Carolina are said to be largely interested in it. Governor Carr is "in favor of the policy of leasing the railroads owned by the state, for the simple reason that it takes them out of politics and puts them on the same footing as the other business enterprises of the state. Under this policy they will be worth something to the state. From a political nuisance they become important factors in the development of the country and from a burden to the tax-payers they are transformed into a source of revenue to the state. The proposition made by the Goldsboro syndicate was a favorable one to the state and I favored its acceptance." The terms of the lease will not be made public until after the meeting of the stockholders.

Atlantic Short Line.—Judge Speer, of the United States District Court for the Southern District of Georgia, signed an order to-day for the sale of the Atlantic Short Line on Nov. 17. No price is fixed.

Baltimore & Ohio.—United States Circuit Court Judge Goff has assigned Nov. 20 for bearing a petition of the Receivers for authority to issue \$650,000 additional certificates at 5 per cent. to pay for improvements on the Pittsburgh & Connellsville road.

Chester & Lenoir.—This road, extending from Lenoir, N. C., to Chester, S. C., 100 miles, was sold at Chester Nov. 2 to W. A. Clarke, of Columbia, S. C., acting for the stockholders and bondholders, for \$70,000. The road was voluntarily placed in the hands of a Receiver several months ago, Major G. W. F. Harper, the President, being appointed Receiver. The bonds outstanding amount to \$850,000. The tracks of the Western North Carolina road, owned and operated by the Southern, are used for some distance, and the latter holds about \$75,000 of the bonds. The new company proposes to issue \$450,000 of five per cent. bonds, of which \$250,000 will be issued for bonds now maturing. Of the remainder, \$75,000 will be used to build the proposed line between Newton and Hickory; where the Western North Carolina tracks are used; \$100,000 will be set aside to meet the bonds on the Lenoir end of the road when they mature, and the remainder will be applied toward improving the roadbed and in purchasing new rolling stock. The stockholders will get new stock.

Cincinnati, Jackson & Mackinaw.—President Calvin S. Brice has ordered a survey of the line from Hudson, Mich., on this line, point on the Lima Northern near Adrian. This would give a direct line from the Ohio coal-fields to Michigan.

The United States Court at Toledo has issued an order for the sale of this road at foreclosure on Dec. 5. The upset price is \$1,000,000.

Detroit, Lansing & Northern.—This road was sold under mortgage foreclosure proceedings on Nov. 10, N. A. Nims, acting for Charles Merriam and Alpheus Hardy, of the Purchasing Committee of the road, bid in the property for \$100,000. The Grand Rapids & Saginaw road which was bid in under similar proceedings at Alma, will be merged into the Detroit, Lansing & Northern.

Grand Trunk.—The earnings to June 30 make the following comparisons:

	1896.	1895.	Inc. or dec.
Gross earn.....	\$1,707,539	\$1,653,092	I. \$54,447
Oper exp.....	1,218,244	1,171,072	I. 47,172
Net earn.....	£489,295	£182,020	I. 27,275
Other income.....	90,176	87,903	I. 2,273
Total income.....	£579,471	£569,923	I. £9,548
Total charges.....	661,533	664,006	D. 2,473
Deficit.....	£82,062	£94,083	D. £12,021

Hoboken Railroad, Warehouse & Connecting Co.—This company, which last summer was restrained from laying tracks through Hudson and Eleventh streets, Hoboken, N. J., to connect a track already laid along

the river front with the New Jersey Junction Railroad carried the matter to the Supreme Court. That court decided last week that the objectors had no standing, and the connection was immediately made after the decision was announced.

Little Rock & Memphis.—The sale at foreclosure, advertised to take place Nov. 10, 1896, was postponed to March 17, 1897. This is the fourth time this sale has been postponed in the last two years.

Middle Tennessee & Alabama.—The control of this road extending from Shelbyville, Tenn., to Decatur, Ala., has been transferred to interests in St. Louis represented by Mr. Joseph Dickson, a lawyer, of that city, and also receiver of the St. Louis, Chicago & St. Paul. The sale includes the transfer of all the first mortgage bonds of the railroad and a majority of its second mortgage bonds and stock. The company was organized early in 1893 as successor to the Decatur, Chesapeake & New Orleans. It was completed in January of the present year from Bonneville, Tenn., to the Alabama-Tennessee state line, 35 miles. The distance from Shelbyville to Decatur is 78 miles. The line is operated by the Cumberland Construction Co., D. K. Young, President, Clinton, Tenn.; C. P. Perin, Vice-President and General Manager, Birmingham, Ala.

New York Central & Hudson River.—The earnings for the three months to Sept. 30 were:

	1896.	1895.	1894.
Gross earn.....	\$11,269,899	\$11,610,505	\$10,840,822
Oper. expen.....	7,596,768	7,745,524	7,114,759
Net earn.....	\$3,673,131	\$3,854,981	\$3,726,063
P. c. exp. to gross earn.....	67	66	6556
Fixed charges.....	2,67,088	2,630,550	2,630,152
Dividend.....	\$1,000,000	\$1,000,000	\$1,192,354
Surplus.....	\$46,043	\$224,431	def. \$96,943

Northern Pacific.—The operations of the old company for the fiscal year ended June 30 are reported as follows:

	1896.	1895.	1894.
Gross earn.....	\$19,433,159	\$17,431,981	\$16,547,209
Oper. expen.....	12,088,988	11,319,682	11,816,120
Net earn.....	\$7,775,771	\$6,115,299	\$4,731,089
P. c. exp. to earn.....	6 76	6 76	7 1%
Total income.....	8,200,781	6,416,528	5,070,893
Operating charges :			
Taxes.....	509,768	501,716	465,825
Rentals.....	163,160	160,764	155,068
Miscellaneous.....	95,563
Total.....	\$672,868	\$759,047	\$620,894
Balance.....	7,527,913	5,657,481	4,149,999

Ohio Southern.—The foreclosure sale has been postponed until Nov. 21, at the request of the Central Trust Co., of New York.

Philadelphia & Reading.—J. P. Morgan & Co., reorganization managers of the company under the plan and agreement of Dec. 14 last, give notice that all holders of certificates of deposit of securities included in that plan, who have failed to pay any assessment and who shall not do so before Nov. 26, shall cease to be parties to the agreement, and will without further notice forfeit their securities with any part of the assessment paid. They announce that up to Nov. 26 they will receive payments of the assessments in full, with 6 per cent. interest and a penalty. After Nov. 26 no further deposits will be received under the plan of reorganization.

A step in connection with the plan to rehabilitate the railroad and coal and iron companies was taken at a special meeting of the stockholders of the National Company at Philadelphia, Nov. 6, at which the capital stock of the company was increased to \$40,000,000. It is generally understood that the National Company is to purchase the controlling interest in both the railroad and coal and iron companies and operate the properties under the name of the Philadelphia & Reading Railroad Company.

The charter of the National Company confers most liberal powers, and was secured from the State in 1871. The act of the legislature incorporating the company and conferring the powers contained in the charter is known as "An act to incorporate the Excelsior Enterprise Company, with power to purchase, improve, use and dispose of property to contractors and others, and for other purposes."

It is stated that the Reading receivers will turn over the property to the Reorganization Committee on Nov. 30, which date includes the fiscal year of the company.

Electric Railroad News.

Binghamton, N. Y.—The Binghamton Railroad Co. reports the earnings and operating expenses of the road for the past five years as follows: Percentage of operating expenses to receipts has decreased from 60 per cent. in 1892 to 56 per cent. for the current year ending Sept. 30. The total cost of the road and equipment has been \$1,200,850; capital stock, nearly \$400,000; net earnings of road for 1892, \$22,432, and net earnings for 1896, \$59,041.

Brooklyn, N. Y.—The gross earnings of the Brooklyn Rapid Transit Company's lines are reported as below:

	1894.	1895.	1896.
Brooklyn Heights.....	\$400,740,18	\$361,956,03	\$373,981,66
B. Queens County & Suburban.....	53,582,72	56,512,89	62,444,04
Total all lines.....	\$154,329,90	\$418,468,92	\$436,425,70
Four months, end-i. g Oct. 31:			
1894.	1895.	1896.	
Brooklyn Heights.....	\$1,672,437.22	\$1,547,485.44	\$1,614,162.09
B. Queens County & Suburban.....	226,853.59	247,605.17	266,633.52
Total all lines.....	\$1,899,290.81	\$1,795,090.61	\$1,880,795.61

Camden, N. J.—The Camden & Suburban Railroad Co. has reached an agreement with the Pennsylvania Railroad Co. relative to crossing the latter's tracks on Third street. The running of cars on the new cross-town road on Third street has been delayed for two months for this reason.

Hartford, Conn.—On Nov. 10 Judge George W. Wheeler, of the Superior Court, handed down a decision in the suit of the New England Railroad Co. against the Hartford Street Railway Co., the Newington Tramway Co. and the Central Railway Co. of New Britain, referred to among our news notes, Oct. 23. The judge makes the temporary injunction permanent, restraining all three electric roads from building a line between Hartford and New Britain.

Montreal, Que.—The annual statement of the Montreal Street Railway Co. for the year ending Sept. 30 is in part as follows:

	1896.	1895.
Gross receipts.....	\$1,265,898	\$1,102,777
Operating expenses.....	710,864	652,811
Net earnings.....	555,033	449,956

The gross earnings for 1895 show an increase of \$163,120, or 14.79 per cent., over 1895, and the operating expenses increased by \$53,052, or by 8.89 per cent. In 1896 the operating expenses were 56.48 per cent. of the car earnings; in 1895 they were 59.21 per cent.; in 1894, 71.16 per cent.; in 1893, 79 per cent., and in 1892, 82.63 per cent. The net income percentage of capital was 11.55 per cent. in 1896 and 10.21 per cent. in 1895. The net profits during the past year were \$462,107, as against \$352,349 for the previous year. The number of passengers carried in 1896 was 4,018,718 in excess of 1895. The figures for the last five years were 28,896,471 in 1896; 25,877,758 in 1895; 20,569,013 in 1894; 17,177,952 in 1893, and 11,631,326 in 1892. The transfers given last year were 8,541,530, or 28% for each hundred passengers.

New London, Conn.—The New London Street Railway Co. has made the following report for the year ending Sept. 30: Gross earnings, \$52,662; net, \$22,648; surplus after fixed charges, and 7 per cent. dividend, \$3,598. Total surplus, \$27,052.

St. Louis, Mo.—C. A. Wurdeman, of Old Orchard,

Mo., has applied for admission to increase the capital stock of the St. Louis & Kirkwood Railroad Company from \$300,000 to \$500,000 and to use \$100,000 for double-tracking the present line.

Washington, D. C.—Judge Cox, of the Equity Court has made an order that the Receiver of the "Belt" Line, which is to run from Washington to Baltimore, be authorized to issue Receiver's certificates to the amount not to exceed \$75,000, the money to be used to complete the road.

TRAFFIC.

Traffic Notes.

The canals of New York state will be closed for the season on Dec. 1.

The San Francisco & San Joaquin Valley has placed its tickets on sale in brokers' offices at Los Angeles. The fare from Fresno to San Francisco is \$3.50.

The Portland *Oregonian* says that freight rates from the East to that city, and to other North Pacific coast terminals, have been reduced to an equality with the rates to San Francisco.

The Pennsylvania Railroad has reduced the minimum charge for carrying bicycles in baggage cars to 10 cents. This is the same as the minimum now in force on the principal railroads in New England.

The Managers of the Joint Traffic Association have recommended that after Dec. 31 next not more than four ticket offices be maintained in New York City by any one company. This refers to city offices, so-called, not including stations and ferries.

On Saturday, Oct. 31, the Erie road carried 8,920 passengers from Youngstown to Canton, O. Nine special trains followed one another at intervals of 10 minutes. The number of cars used was 113, and 40 more could have been used if they had been available.

The Board of Administration of the Southwestern Traffic Association has made a through-rate agreement with the principal railroads of Mexico. On freight from New York to the City of Mexico, the Mexican Traffic Association will make the rates, competition of all water lines having to be constantly dealt with. From interior points the roads in the Southwestern Traffic Association will make the rates. From St. Louis to the City of Mexico rates are to be 8 cents per 100 lbs. higher than the steamship rates from New York, which is a considerable reduction from the tariffs hitherto in force. Rates to Mexico, by railroad to New Orleans, Mobile, etc., and thence by water, are to be on the basis of 31 cents (first-class) less than all-rail rates.

William Johnson & Co., of Liverpool, have arranged to run a regular line of steamships to Europe from Charleston and Savannah. The Savannah papers say that this arrangement has been brought about by Mr. Comer, of the Central of Georgia. Savannah merchants say that they have not had their share of the cotton export business lately, owing to the high freight rates from that port to Europe. Charleston papers state that the South Carolina & Georgia Railroad is interested in the establishment of the new line and that it has made arrangements with its Western connections for through rates from St. Louis and other points west, which, it is expected, will bring export grain to Charleston. At Norfolk the credit of establishing the new line is given to Mr. Spencer, of the Southern Railway, and the steamers are to sail from that port. It is also stated that Brunswick, Ga., will be one of the termini of the line.

Chicago Traffic Matters.

CHICAGO, Nov. 11, 1896.

The reorganized Western Freight Association is being managed at present entirely by Chairman Midgley, though two other administrators accepted the positions. The two vacancies were considered at a meeting held in St. Louis yesterday, and press dispatches report that H. H. Courtright, General Freight Agent of the Chicago & Alton, and H. L. Shute, Traffic Manager of the Great Northern, have been selected to fill them.

Central Passenger Committee roads will keep the reduced rates to Canton, O., in force until Nov. 15.

Total shipments to the East by lake last week were 131,290 tons, of which 117,698 tons were grain. All-rail shipments amounted to 68,698 tons, compared with 78,788 tons for the preceding week, a decrease of 10,000 tons, and against 80,008 tons for the corresponding week of last year.

The proportions of the all-rail business carried by the different roads were:

Roads.	WEEK TO NOV. 7.		WEEK TO OCT. 31.	
	Tons.	p. c.	Tons.	p. c.
Michigan Central.....	7,799	11.3	8,256	10.5
Wabash.....</				